United States
Department of
Agriculture

Soil
Conservation
Service

Illinois
Department of
Transportation

Division of
Water
Resources

FLOODPLAIN MANAGEMENT STUDY

BUTTERFIELD CREEK AND TRIBUTARIES

COOK-WILL COUNTIES, ILLINOIS

NOVEMBER 1987

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AND TRIBUTARIES
COOK AND WILL COUNTIES
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INTRODUCTION

This report defines the flood characteristics of Butterfield Creek and its tributaries in Cook and Will Counties. The tributaries studied are Flossmoor Tributary, East Branch of Butterfield Creek, and the Tributary to East Branch. This report defines the flood hazard of existing buildings located along or near these streams. This existing flood hazard is the basis used for the evaluation of measures to eliminate or reduce flood damages.

Several different alternatives were evaluated and are described in the report. No structural measure evaluated was determined to be cost effective ie: annual benefits exceeded annual costs. Appendix F provides information on existing building elevations in relation to the floodwater elevation for the 10 percent, 1 percent, and 0.2 percent chance (500 year) recurrent floods for present and future runoff conditions. This appendix has been published under separate cover and copies provided to the local governments involved. This report points out the importance of protecting existing storage, provides data on the impact of floodproofing 40 buildings, and provides data that can be used for regulation of new development in the floodplain areas.

Floodprone areas in many locations are a severe problem in Illinois. Watershed urbanization and development within and upstream of the floodplain areas intensify this problem. Currently there are 793 Illinois communities identified as having flood problems. As of March 1, 1985, 735 communities within Illinois are participating in the National Flood Insurance Program (NFIP). The Illinois Department of Transportation, Division of Water Resources (DWR) is the state agency assigned urban flood problems and for setting priorities for flood studies within the urban areas. A joint coordination agreement was executed between DWR and the Soil Conservation Service (SCS) on April 30, 1976 and was revised December 1978 to furnish technical assistance in carrying out these flood hazard studies. These studies are carried out in accordance with Federal Level Recommendation 3 of "A Unified National Program for Floodplain Management," and Section 6 of Public Law 83-566. A Plan of Work was executed by DWR and SCS in October 1984, for the Butterfield Creek and Tributaries Floodplain Management Study. The cost of this study was shared among DWR and SCS.

The Little Calumet River Watershed Plan published in 1978 (Reference 1), identified limited flood damages along Butterfield Creek and did not evaluate damages along the East Branch of Butterfield Creek. The June 1981 flood in the watershed showed significantly higher damages than predicted along Butterfield Creek. In addition, damages in Matteson along the East Branch of Butterfield Creek exceeded $380,000. Therefore, it was apparent that total damages as evaluated by the Little Calumet Watershed Plan must be too low for the Butterfield Creek portion of the Little Calumet River Watershed.

Local officials feel that the frequency of flooding exceeds acceptable levels. They also feel that the new development planned in the upstream reaches will probably increase the flood problem. This report supports both of the above statements.

State of Illinois was asked to provide assistance to solve the flood problem associated with Butterfield Creek. Prior to committing funds for flood control, the State requires completion of a floodplain management study identifying existing hazards and alternative solutions. The State requests the study display the beneficial and adverse impacts of all alternatives considered.

This report is based on the results of a detailed hydrologic and hydraulic analysis of the Butterfield Creek Watershed and the damage analysis made for the identified floodprone areas. The maps and profiles in this report are adequate for floodplain regulation of the streams studied in detail. The floodway was delineated in accordance with Chapter 19, Illinois Revised Statutes of 1973, 65F (Reference 7). Floodwater elevations and first floor elevations for all surveyed buildings in the identified floodplain have been provided to each community in the watershed and to IDOT Division of Water Resources.

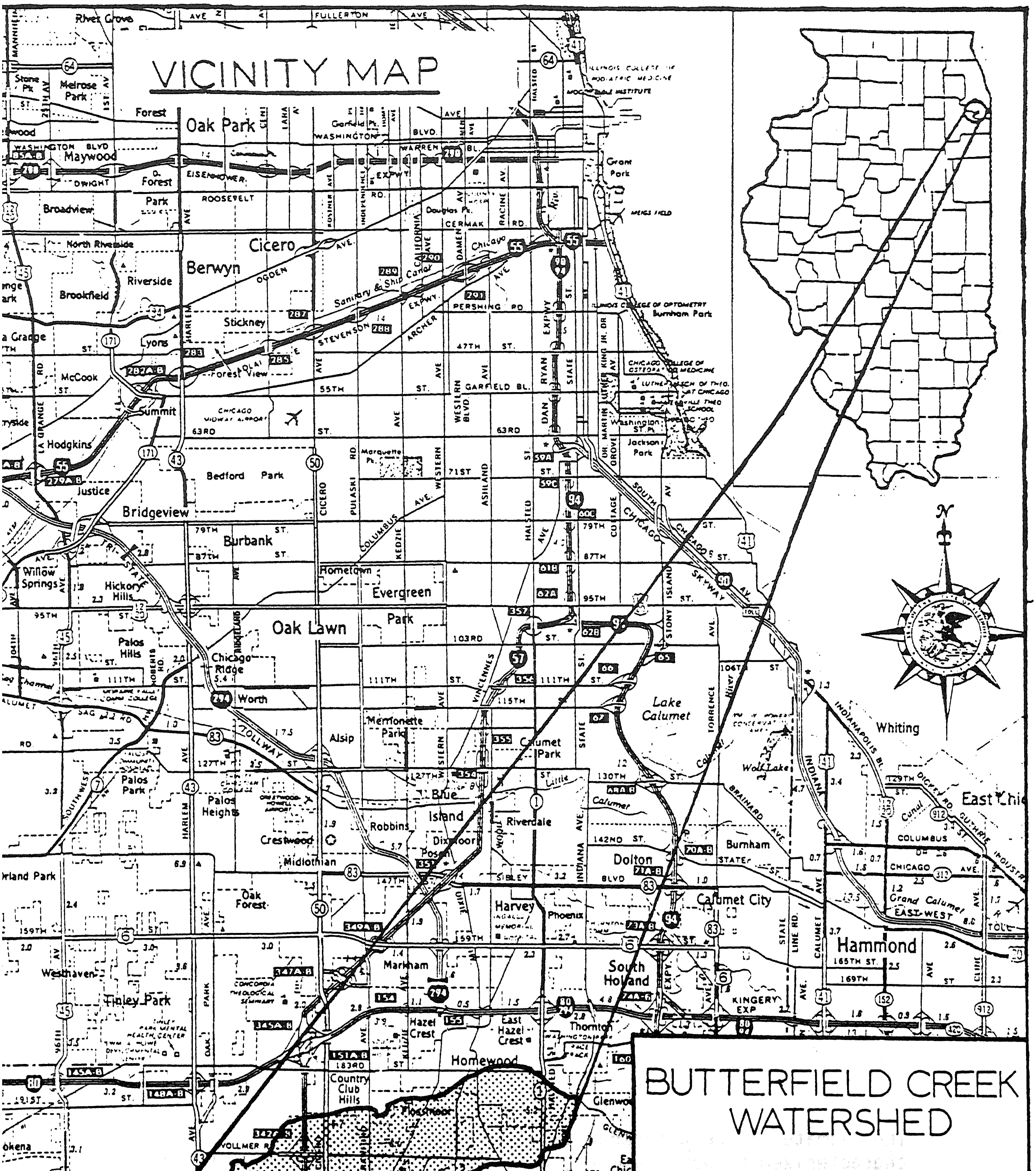

VICINITY MAP
BUTTERFIELD CREEK WATERSHED
COOK & WILL COUNTIES, ILLINOIS
River Grove
Melrose Park
Stone Pk.
Oak Park
Maywood
Forest Park
Broadview
North Riverside
Cicero
Berwyn
Riverside
Brookfield
Stickney
Lyons
Forest View
McCook
Summit
Hodgkins
Justice
Bedford Park
Bridgeview
Burbank
Hometown
Evergreen Park
Oak Lawn
Willow Springs
Hickory Hills
Palos Hills
Chicago Ridge
Worth
Merrionette Park
Alsip
Calumet Park
Palos Park
Palos Heights
Blue Island
Riverdale
Robbins
Crestwood
Dixmoor
Posen
Midlothian
Orland Park
Oak Forest
Harvey
Phoenix
Dolton
Burnham
Calumet City
Hammond
Markham
South Holland
Westhaven
Tinley Park
Hazel Crest
East Hazel Crest
Thornton
Homewood
Country Club Hills
Flossmoor
Glenwood
Lincoln Estates
Olympia Fields
Chicago Heights
Matteson
Richton Park
Park Forest
S. Chicago Heights
Steger
Crete
Park Forest South
St. John
Faithorn
Monee
Lake Calumet
Wolf Lake
Whiting
East Chicago
Cook
Grant Park
Burnham Park
Jackson Park
Washington Park
Douglas Pk.
Garfield Pk.
Marquette Pk.
Sanitary & Ship Canal
Eisenhower Expwy.
Stevenson Expwy.
Dan Ryan Expwy.
Calumet Skyway
Kingery Exp
Tri-State Tollway
Chicago Midway Airport
Meigs Field
and Champaign
To Kankakee and Springfield
To Danville
To Ill. Rt. 1
To Terre Haute

FIGURE 1

DESCRIPTION OF STUDY AREA

Butterfield Creek Watershed is located in Cook and Will Counties approximat 30 miles south of the Chicago Loop. Butterfield Creek is a perennial strea originating near Richton Park, Illinois (See Figure 1). The approximate drainage area of Butterfield Creek is 26 square miles at its confluence wit Thorn Creek, a tributary of the Little Calumet River, Glenwood. The hydrologic sub-watershed number is 07120003-050.

The Butterfield Creek Floodplain Management Study is concerned with the floodplain along Butterfield Creek from its junction with Thorn Creek to upstream of Highway 30 (Lincoln Highway), and its tributaries (Flossmoor Tributary, East Branch Butterfield Creek, and the Tributary to the East Branch). The channels flow through the communities of Glenwood, Homewood, Flossmoor, Olympia Fields, Matteson, and Richton Park. In addition it flows through several country clubs and unincorporated Cook County.

The upper portion of the watershed has been undergoing rapid development in the last 20 years and is expecting extensive additional development in the next 20 years. See Figures 5 and 6 for present (1985) and estimated future (2005) land use in the watershed.

The formation of the soils in this watershed was influenced by the glaciers which covered the area. The topography varies from level and nearly level tc rolling with numerous depressions. The parent materials are loess, coarse ar medium textured glacial outwash, glacial till, alluvium, and organic deposits (Reference 12, 13)

Drainage characteristics of the soils vary across the drainage scale; well drained, moderately well drained, somewhat poorly drained, poorly drained, an very poorly drained. Water is removed readily from well drained soils but is available to plants throughout the growing season. Drainage in well drained soils is not a limiting factor for most non-agricultural uses. At the other end of the drainage scale, water is removed from the soil so slowly that free water remains at or near the surface during most of the year. Artificial drainage is necessary for most crops to be grown. The very poorly drained soils have severe limitations on both agricultural and non-agricultural uses. Poor drainage can result from a high water table, a slowly pervious layer within the profile, seepage or a combination of these.

The well drained soil series are Markham, Morley, and Grays. The somewhat poorly drained soils are Beecher, Elliott, Frankfort, Martinton, and [illegible] oils are Ashkum, Milford, and Sawmill. The [illegible] ghton and Peotone.

[illegible] classified as humid continental which is characterized by warm summers, cold winters and relatively large daily, monthly and yearly variations in both temperature and precipitation. Average annual precipitation is 33 inches. March through October precipitation averages 3 inches monthly. Mean annual runoff is approximately 9 inches or about 27 percent of total precipitation (Reference 5 and 13).

During January, normally the coldest month, temperatures range from a normal maximum of 35 degrees F to a normal minimum of 19 degrees F. During July, normally the warmest month, temperatures range from a normal maximum of 87 degrees F to a normal minimum of 64 degrees F. The maximum temperature of 90 degrees F is exceeded on 30 days in a normal summer. The average frost-free season is 160 days (Reference 5 and 13).

Based upon the 1980 Census of population, the populations of Cook and Will Counties were 5,253,655 and 324,460 respectively. From the period 1970 to 1980 Cook County registered a 4.3 percent decrease in population while Will County experienced a 30.9 percent increase in growth. (Reference 14). Rich Township, which composes a significant portion of this watershed, had a 31% increase in population between 1970 and 1980 from 44,800 to 58,730. The number of housing units in Rich Township increased from 12,540 to 20,397 between 1970 and 1980.

The unemployment rate within the study area has been below state and national averages. According to the Illinois State Employment Security Office, the 1985 unemployment rate for both Cook and Will Counties was 8.8 percent versus a 7.5 and 9.1 for the United States and the State of Illinois respectively.

The per capita income for Cook County was higher than the State of Illinois and national averages for 1984 according to the Bureau of Economic Analysis. Cook County registered per capita personal income of $14,199, while Will County was reported to be at $12,747, as compared to $12,772 and $13,705 for the United States and State of Illinois respectively.

NATURAL VALUES

The Butterfield Creek Watershed is located in a extensively developed area with the upstream portions primarily undeveloped at this time. The new projected development will consist of a mix of commercial with single and multiple family residences. The portion of the watershed with most of the projected development is in Matteson near Highway 30 and Interstate 57. Othe areas projected are located in Richton Park. The table which follows illustrates this rapid change:

Table 1

LAND USE	APPROXIMATE AREA (% OF WATERSHED)		
	1972	1985	2005 (Est.)
Urban	49%	59%	73%
Agricultural	32%	25%	14%
Open space	18%	15%	12%
Other	1%	1%	1%

The agricultural land is primarily located west of Crawford Avenue in the western portions of the watershed (See Figure 5). Most of the soils in the watershed are on the State list of prime farmland soils. Houghton Muck and Muskego are classified as important farmland. Currently it is estimated that 315 acres of farmland are in the floodplain identified in the detailed study area of this report. The detailed evaluation of the watershed shows that existing upland storage areas and low areas along the channels of the watershed provide over 1700 acre feet of storage during a 1% chance (100 year) flood. The study has identified 16 of these areas which include the man made reservoirs on the Tributary to East Branch in Richton Park. Appendix E includes detailed sketches of each of these storage areas. It is estimated that if these storage areas were lost the 100 year peak discharge would increase by 35% to 50%.

The significant wildlife habitat in the Butterfield Creek Watershed exists primarily in the natural wooded areas scattered throughout the watershed. Isolated wetland areas are located along the watershed divide in the Cook County Forest Preserve. The natural wetlands scattered along the drainageways provide both wildlife habitat and floodwater storage.

Primary plant communities in the wooded areas are upland hardwood forest and upland and lowland successional communities. The remaining part of the watershed is either used for row crop production, or is developed urban land. Wildlife habitat quality varies from poor to moderate in the intensively developed areas.

More than half of the Butterfield Creek Channel is in its natural condition. The remainder has been modified for drainage or development purposes. The Butterfield Creek channel in the farmland areas west of Cicero Avenue is a combination of natural channel and modified channel. In some reaches minor straightening and diking has occurred to reduce flooding damages to cropland.

Approximately 2500 acres (60%) of the land currently farmed has an average erosion rate of up to 10 tons per acre. It is estimated that 450 of these 2500 acres would be classified as critically eroding areas.

The channels of Butterfield Creek and most of the tributaries occur almost entirely in the poorly drained Milford silty clay loam or Sawmill silty clay loam soils. Surface runoff is very slow and often may be ponded. The potential of Milford or Sawmill for urban uses is poor because of the wetness problems. Natural vegetation is bottomland hardwoods, but significant portions of Butterfield Creek has been encroached upon by development and much of the natural vegetation is gone. The present vegetation is a mixture of native plants such as silver maple, elm, swamp white oak, willow, hawthorn, ash, bur oak, basswood, cottonwood, gray dogwood, American cranberry bush, and nannyberry and introduced landscaping plants such as honeysuckle, Siberian elm, buckthorn and other ornamentals. The upper portion of Butterfield Creek s through open grassland or land currently being used for row crops.

A rich variety of wildlife species are associated with the plant communities described above. Wetlands in particular provide very important habitat conditions. The environmental setting portion of the Little Calumet River Watershed Plan identified the following wetlands in Butterfield Creek watershed:

W5-SE 1/4 of SE 1/4, Sec 8, T35N, R13E. A type 4 wetland of about 5 acres. Surrounded by about 10 acres of type 3 inland shallow fresh marsh.

W6-SE1/4 of SW 1/4, Sec 9, T35N, R13E. A type 4 inland deep fresh marsh surrounded by a type 3 wetland. Total area equals about 40 acres.

W7-Center of Sec 9, T35N, R13E. A type 3 shallow fresh marsh of about 15 acres.

W8-SE 1/4 of SW 1/4 Sec 21, T35N, R13E. A type 5 wetland of about 5 acres.

W9-SE 1/4 of SE 1/4 Sec 28, T35N, R13E. A type 5 wetland of about 3 acres.

W10-SE 1/4 of NW 1/4 Sec 14, T35N, R13E. A type 3 inland shallow marsh of about 4 acres.

W11-SW 1/4 of SE 1/4, Sec 11, T35N, R13E. A type 3 inland shallow marsh of about 5 acres.

ield review in 1986 indicates that W9, W10.
rban development since 1978.

he 1981 List of Endangered and Threatened
ites 39 plant species known to exist in C(
esignated as endangered or threatened. Tl
nimals that are designated as threatened.

o archaeological sites or historical site:
etailed study area.

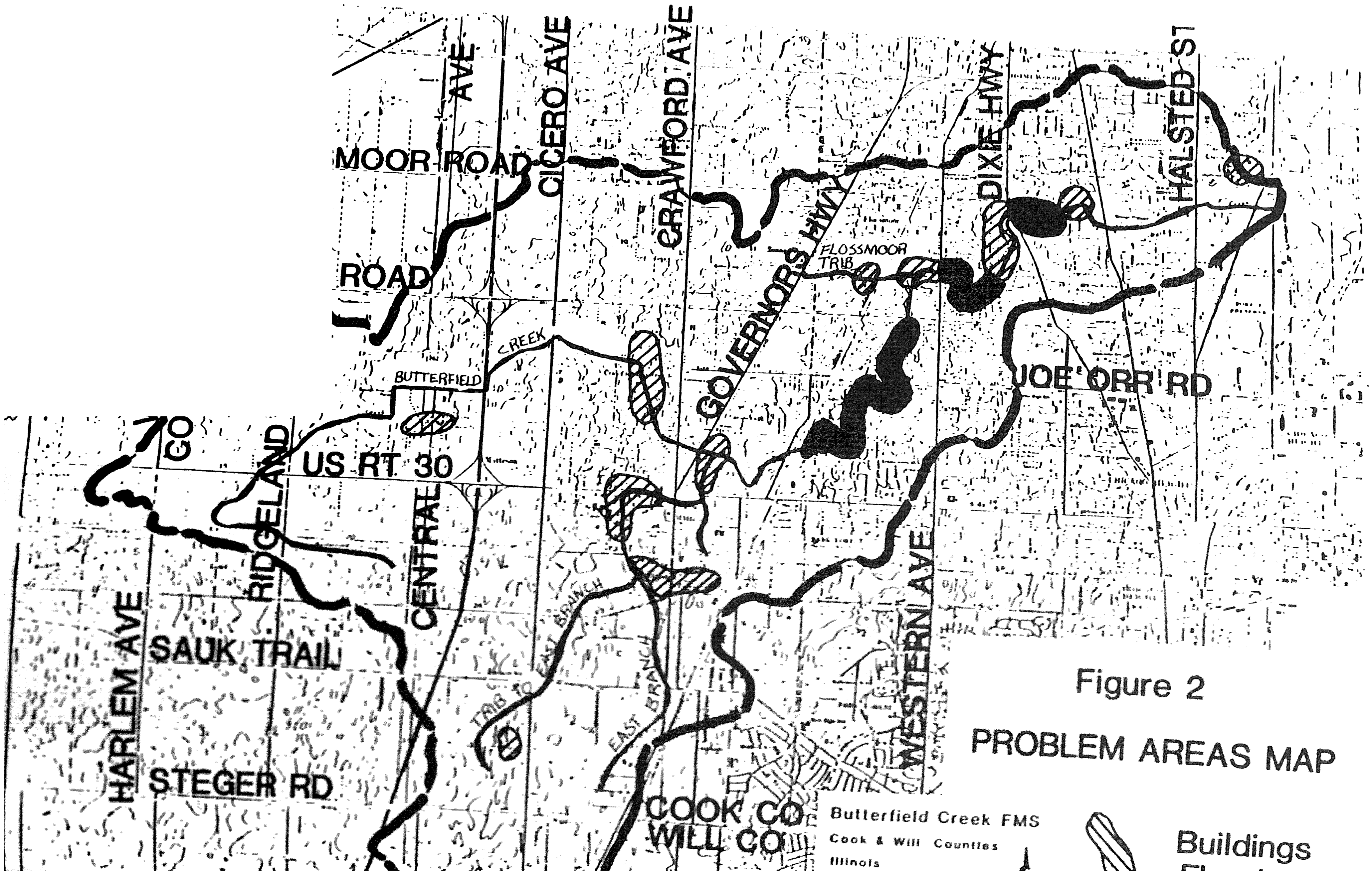


Figure 2

PROBLEM AREAS MAP

FLOOD PROBLEMS

he primary damage areas evaluated as part of this study are shown on Figure . The majority of the identified buildings subject to flood damage are esidential dwellings. The primary commercial damage identified is along ighway 30 in Matteson. The following table summarizes the number of uildings flooded under present land use (1985) conditions by the 1% chance 00 year flood and the calculated average annual damage by evaluation reach. See Figure 5 for Present Land Use).

Table 2
PROPERTIES FLOODED - PRESENT LAND USE
1% CHANCE FLOOD

OCATION	NUMBER OF BUILDINGS	AVERAGE ANNUAL DAMAGES
utterfield Creek		
downstream of Halsted	3	$ 3700
between Dixie Hwy & Halsted	7	6600
between Vollmer & Dixie	24	36500
between Crawford & Vollmer	5	8200
between I-57 & Crawford	10	8400
upstream of I-57	2	300
ast Branch Butterfield Creek		
between Conrail tracks & mouth	7	28400
between EJ&E RR & Conrail	55	30300
upstream of EJ&E RR	2	400
ributary of East Branch		
entire length studied	12	23200
lossmoor Tributary		
entire length studied	12	22700
OTAL	139	$168700

able 2 shows that the largest number of buildings are flooded on the East ranch of Butterfield Creek between the Conrail tracks and the EJ&E Railroad racks in Matteson. Most of these buildings are in the residential area ocated east of Governor's Highway along 217th Street, 216th Place, or Richton oad. These are predominately single family dwellings with basements, ranging n value between $55,000 and $75,000. Most of these buildings were damaged uring the June 1981 flood.

he largest dollar damage reach is located between Vollmer Road and Dixie ighway in Flossmoor. These damages occur at 2 locations. The largest number f buildings, 20, are located on or near Dartmouth Road just west of Dixie ighway. Damages to these buildings are estimated to be $25,700 annually. hese buildings are single family dwellings, many with basements, ranging in alue from $125,000 to $225,000. Many of these buildings were damaged by the une 1981 flood. The other damage area is near Butterfield Road west of estern Avenue. Four buildings here have an estimated annual damage of 10,800. These buildings are residences valued in excess of $300,000.

ccording to Flood Insurance data provided by FEMA, the June 1981 flood amaged more than 75 buildings with total damages well in excess of $400,000. t is estimated that the June 1981 flood was from a rainfall event equal to or reater than a 4% chance storm. A review of existing gauge records shows that he average discharge passing the gauging station at Riegel Road has increased ver the past 10 to 15 years. The number of floods over 600 cfs presently verages over 1.5 times per year while during the period 1960 to 1975 it veraged less than once per year. Local citizens feel that the upstream evelopment on the East Branch of Butterfield Creek has caused most of this hange in frequency of flooding.

The 3 golf courses located in the lower portion of the watershed all rep increasing problems with flood damages and bank erosion. Based on the interview data it appears these problems are more serious on the Flossmo Olympia Fields Country Clubs than on Idlewild Country Club. Estimated a damages to these clubs is $25,000.

The existing natural storage in the watershed exceeds 1700 acre feet and has had a significant effect on reducing the peak discharges throughout Butterfield Creek Watershed. Many of these storage areas are zoned for commercial or residential usage. Loss of the storage will result in significant increases in peak discharges and increased flood damages.

The following table summarizes by frequency the evaluated urban damages f the Butterfield Creek Watershed for present land use conditions:

Table 3
TOTAL DAMAGES BY FREQUENCY
Present Without Project

Frequency % Chance	Year	Total Buildings (Number)	Total Damage (1000 Dollars)
0.2	500	213	6,153
1.0	100	139	2,622
2.0	50	107	1,648
4.0	25	85	1,008
10.0	10	61	440
20.0	5	43	241
50.0	2	1	5

Average Annual Damages = $168,700

The future condition without project evaluation was developed to predict runoff and damage conditions in the year 2005. The future condition land us is shown in Figure 6. The evaluation assumes all new development will have on-site detention storage amounting to 1.5 inches per acre of new developmen with a release rate of 0.5 cfs per acre. It is assumed that all existing natural storage (1700+ acre feet) will be maintained or compensated for when the new development occurs. This evaluation shows a slight increase in peak discharges for most locations in the watershed.

Th- - --

by reaches of the evaluated future condition the land use shown on Figure 6.

Table 4

PROPERTIES FLOODED - FUTURE LAND USE

1% CHANCE FLOOD

)CATION	NUMBER OF BUILDINGS	AVERAGE ANNUAL DAMAGES
ɹtterfield Creek		
downstream of Halsted	3	$ 3700
between Dixie Hwy & Halsted	8	8300
between Vollmer & Dixie	25	43800
between Crawford & Vollmer	6	14600
between I-57 & Crawford	10	10900
upstream of I-57	1	700
ast Branch Butterfield Creek		
between Conrail tracks & mouth	11	42500
between EJ&E RR & Conrail	57	30800
upstream of EJ&E RR	2	300
·ibutary of East Branch		
entire length studied	12	22900
lossmoor Tributary		
entire length studied	12	21800
)TAL	147	$200300

ıe largest increase in damages in this evaluation is along Highway 30 on the ast Branch of Butterfield Creek. This increase is primarily due to the ıcreased peaks caused by the change in timing because of the new development.

Table 5

TOTAL DAMAGES BY FREQUENCY
Future Without Project

Frequency % Chance	Year	Total Buildings (Number)	Total Damage (1000 Dollars)
0.2	500	229	7,301
1.0	100	147	3,442
2.0	50	118	1
4.0	25	89	1
10.0	10	62	
20.0	5	45	
50.0	2	2	

Average Annua

ɘveral major roads are flooded during flo ccurs where Governor's Highway goes under ıderpass carries the majority of the flow ılverts under the EJ&E tracks will not ca ɔing through the underpass. Other roads ighway, Vollmer Road, and Central Avenue. ıese traffic interruptions are estimated

EXISTING FLOODPLAIN MANAGEMENT

Currently, all the communities in the watershed, unincorporated Cook Co and unincorporated Will County, are participating in the Regular Phase National Flood Insurance Program (NFIP). This program provides data to local government so that they can adopt floodplain management measures. The flood insurance study includes a flood boundary map with a floodway desi to assist the community in enforcing the rules it will use to regulate l use. There are existing flood boundary maps and profiles available for Butterfield Creek and the tributaries. These maps and profiles are b used to regulate new construction in the areas subject to flooding. In addition, existing ordinances in the communities call for compensatory s when new development occurs in the identified floodplain.

These existing flood boundary maps did not identify many of the areas flo during the June 1981 flood (estimated to be a 4% chance flood). Therefor not all areas subject to flooding by the 1% chance flood were being regul because not all are identified on the maps being used for regulation.

Since the June 1981 flood, the existing hazard to many of the unmapped ar have been recognized by local governments. The communities involved have assisted in the evaluation of the flooding problem throughout this study a recognize that the maps included in this report will be available for use the Federal Emergency Management Agency (FEMA) to update the flood insuran maps for the communities involved in accordance with guidance from Congress This report includes both the 100 year (1% chance) floodplain and the 500 y 0.2% chance) floodplain.

In order to provide a national standard without discrimination, the 100 yea flood (1% chance) has been adopted by State and Federal agencies as the bas flood for purposes of floodplain management measures. The 500 year (0.2% chance) flood is employed to indicate areas of additional flood risk within community. For all the streams studied in detail, the boundaries of the 100 year and 500 year flood for present runoff conditions have been delineated. These flood boundaries have been determined by using the flood elevations calculated for each valley cross section. Between the surveyed cross sections, the floodplain boundaries were interpolated using topographic maps prepared at a scale 1 inch - 200 feet (contour interval of 2 foot). In cases where the 100 year and 500 year flood boundaries are close together, only the 100 year boundary has been shown. The boundaries of the floodplains are show on the floodplain maps.

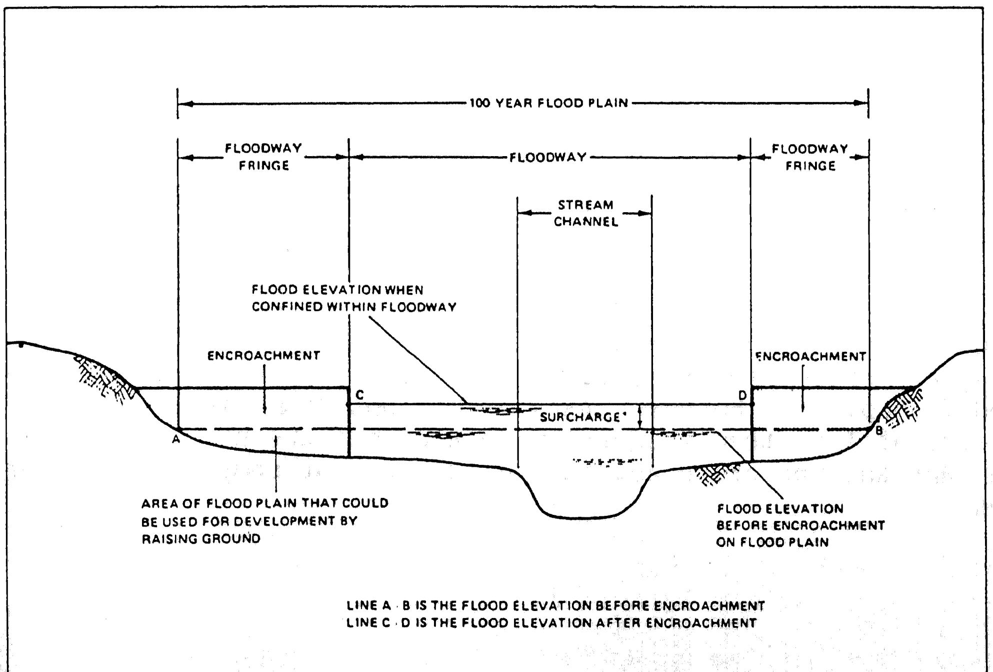
Small areas within the flood boundaries may lie above the flood elevations an therefore not be subject to flooding. However, due to the limiting scale of the topographic maps used to prepare the floodplain maps, such areas are not shown. The profile sheets in Appendix A should be used to ascertain flood elevations for any specific point along Butterfield Creek and Tributaries for present runoff conditions. Copies of the future condition profile sheets will be provided to each of the local governments currently regulating land use in the watershed. In addition, Appendix F lists the present and future 10 year, 100 year and 500 year flood elevations for all buildings surveyed in the floodplain. Encroachment on floodplains, such as artificial barriers, reduces the water carrying capacity and increases flood heights thus increasing flood hazards in areas beyond the encroachment itself. One aspect of floodplain management involves balancing the economic gain from the floodplain development against the resulting increased flood hazard.

For purposes of the NFIP, the concept of a floodway is used as a tool to assist local communities in this aspect of floodplain management. Under this concept, the 100 year floodplain is divided into floodway and a floodway fringe. The floodway is the channel of the stream plus any adjacent floodplain areas that must be kept free of encroachment in order that the 100-year flood discharge can be carried without a substantial increase in flood heights. In this case, blockage of the adjacent floodplain areas without blocking the channel will result in increasing the flood elevations. The floodway fringe area ie: all the floodplain except floodway, is not required to convey the flows but does act as a storage area on flat streams (See Figure 3 for sketch).

In Illinois, the minimum standard used to define the 100 year floodway is described in the Illinois Revised Statutes of 1973 under 65F, Chapter 19 (Reference 7). In this standard, the encroachment in the floodplain is limited to that which will cause only an insignificant increase in flood heights. The Illinois Division of Water Resources has recommended that the floodway be determined using no more than a 0.1 foot surcharge (Reference 3). The floodway proposed for this study, using the 0.1 foot surcharge, was computed by equal conveyance reduction from each side of the floodplain.

As shown on the flood boundary and floodway maps, the floodway boundaries were determined at individual cross sections. Between the cross sections the boundaries are interpolated.

The area between the floodway and boundary of the 100 year flood is termed the floodway fringe. The floodway fringe thus encompasses the portion of the floodplain that could be completely obstructed without effecting the conveyance in such a manner as to increase the water surface elevation of the 100 year flood more than 0.1 of a foot at any point. The typical relationship between the floodway fringe and the floodway are shown in the floodway schematic (Figure 3).



*SURCHARGE NOT TO EXCEED 0.1 foot by State of Illinois requirements.

FIGURE 3

FLOODWAY SCHEMATIC

SIGNIFICANCE OF NATURAL STORAGE

The preservation of existing natural storage is of major importance to this watershed. The following table shows the impact of this natural storage on the peak discharges along Butterfield Creek and Tributaries for present run conditions and future runoff conditions.

Table 6

PEAK DISCHARGES - PRESENT AND FUTURE

Location	Drainage Area	With Natural Storage Present		With Natural Storage Future		Without Natural Sto Future	
		10yr	100yr	10yr	100yr	10yr	100yr
	sq mi	cfs		cfs		cfs	
mouth Butterfld	26.0	1720	2740	1760	2890	2270	3990
Butterfld @ Dixie	23.0	1650	2770	1690	3000	2280	4050
Butfld @ Crawfd	9.5	510	830	530	860	940	1660
Butfld @ I-57	4.9	345	470	345	470	1350	2000
E Branch @ mouth	7.0	1000	1400	1050	1450	1570	2480
E Branch @ Conrail	5.4	900	1270	930	1300	1570	2640
E Branch @ Sauk Trl	1.5	650	1050	650	1050	650	1050
Trib to E Branch @ Conrail tracks	2.4	630	790	650	810	830	1350
Trib to E Branch @ Cicero Av	1.3	480	700	480	700	480	700

The future runoff condition evaluation assumed that all new development will include on-site detention storage of 1.5 inches with a release rate of 0.5 cfs/acre. This is one way of describing what the current on-site storage requirements are in the communities located in the Butterfield Creek watershed. In addition, the future evaluation, used to predict annual damage in 2005, assumes that all existing natural storage, over 1700 acre feet, is maintained in the watershed. See Appendix E for detailed information on the 16 storage areas.

The future without natural storage evaluation assumes all upstream natural storage except that located on the Cook County Forest Preserve and that constructed on the Tributary to East Branch is not maintained. This is an extreme evaluation as probably 30% of this storage would be maintained if current compensatory storage requirements are enforced. Most of the existing ordinances require compensatory storage for any new development in an identified floodplain. However, many of the upstream storage areas have a drainage area of less than 1 square mile and thus are not included in flood insurance maps and therefore not subject to current compensatory storage ordinances.

The following table summarizes the estimated number of buildings and damages that would occur if this natural storage is lost and existing bridge sizes are maintained.

Table 7

Properties Flooded - Future Land Use - Without Natural Storage

Location	Number of Buildings 1% Chance Flood Residential	Non-Residential	Average Annual Damages Residential	Non-Residential
Butterfield Creek				
downstream of Halstead	1	2	$1,300	$2,400
between Dixie & Halstead	8	1	15,700	4,800
between Vollmer & Dixie	38	2	111,900	200
between Crawford & Vollmer	11	-	62,000	-
between I-57 & Crawford	46	-	109,000	-
upstream of I-57	44	1	143,500	282,900 1/
East Branch Butterfield Creek				
between Conrail tracks & mouth	10	10	22,000	272,300 2/
between EJ&E & Conrail	79	-	86,600	-
upstream of EJ&E tracks	2	3	300	300
Tributary to East Branch				
entire length studied	41	3	41,300	14,800
Flossmoor Tributary				
entire length studied	42	5	87,400	39,000
Subtotal	322	27	$681,000	$616,700
TOTAL	349		$1,297,700	

1/ Damage to school near Central Avenue.
2/ Includes damages to Lincoln Mall.

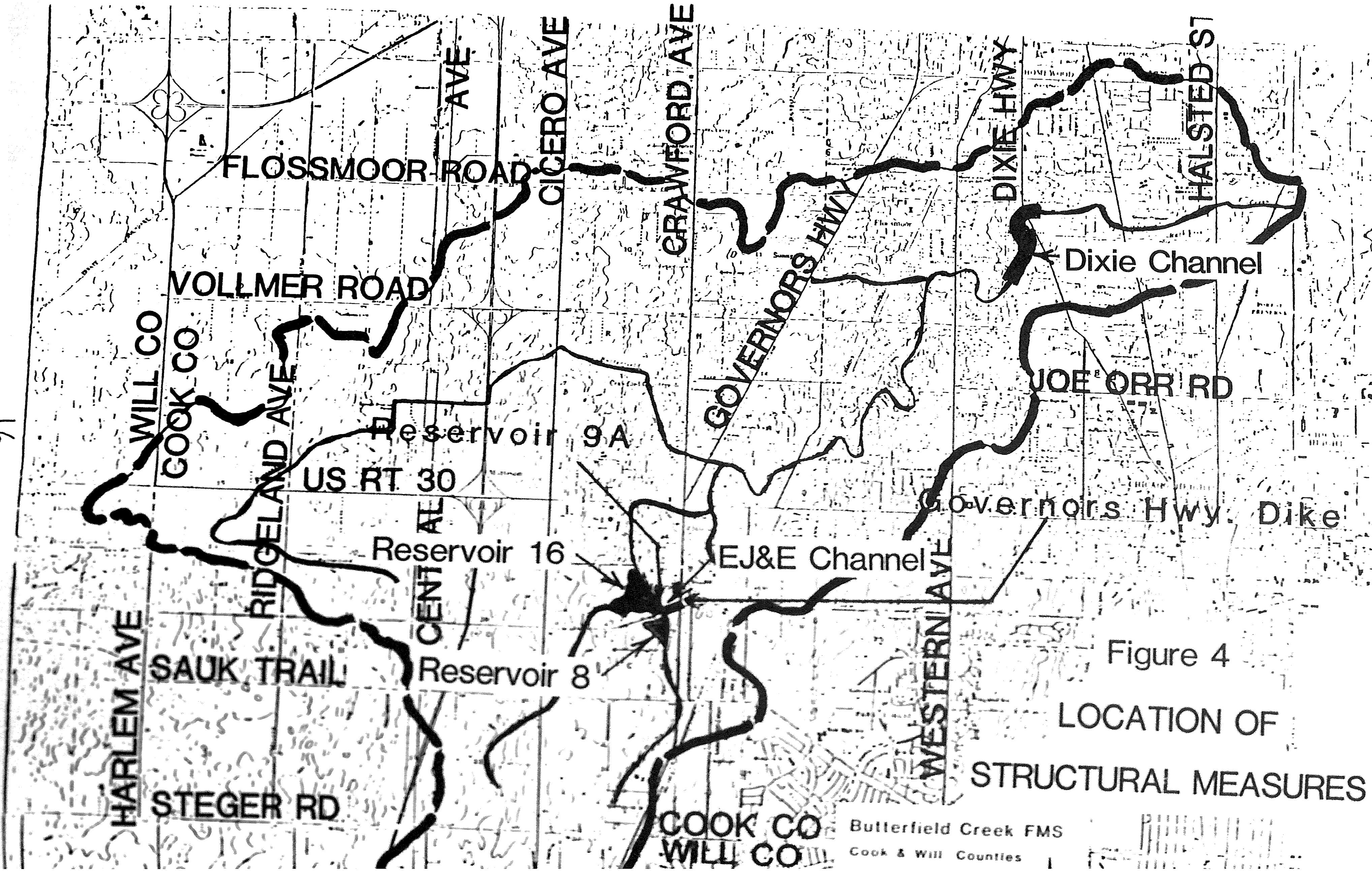


Figure 4
LOCATION OF
STRUCTURAL MEASURES

STRUCTURAL MEASURES EVALUATED

The following describes the different structural measures evaluated as part of the study. Since the damage areas are widely scattered it was readily apparent that no one structural measure could solve all of the problems. Therefore, several different structures were evaluated and their impacts determined. The following discussion describes the most feasible of these structural measures. See Appendix C for sketches of each measure, Appendix D for detailed information on costs, and Figure 4 for the location of these measures.

Dixie Channel

A total of 3 different lengths of 20 foot bottom width channel with 3:1 side slopes near Dixie Highway were evaluated. These were 3500 ft, 1200 ft, and 750 ft. The first two include 450 ft of channel downstream of Dixie Highway on Idlewild Golf Course with the remainder located upstream of Dixie Highway in Flossmoor. The following summarizes the components, costs and benefits of these evaluated channels.

Components	Units	3500 Ft	1200 Ft	750 Ft
Excavation	cu yds	16,400	11,150	7,740
Bridges	ea	3	4*	1
Land rights	acres	8	3	1.7

* Includes replacing Dixie Hwy bridge.

Costs		3500 Ft	1200 Ft	750 Ft
Construction	$	270,800	369,200	76,090
Engr & PA	$	54,200	73,800	15,210
Land rights	$	320,000	120,000	68,000
Total	$	645,000	563,000	159,300
Av Annual	$ (8 7/8%)	57,200	50,000	14,140
OM&R	$	1,700	1,700	1,160
Total Annual Cost	$	58,900	51,700	15,300

Benefits		3500 Ft	1200 Ft	750 Ft
Total Annual Benefits	$	22,200	17,500	15,100
Net Benefits	$	-36,700	-34,200	-200
Benefit/cost Ratio		0.38:1	0.34:1	0.98:1

Additional Effects: The installation of the 3500 ft channel would involve the removal of trees from the back yards of 15 to 20 homeowners and the reshaping of the existing channel. Several of the homeowners present at the March 1987 public meeting stated they did not want their existing channel conditions changed. The 3500 channel would lower the 100-year profile from 1.0 to 2.0 ft for a length of 4000 feet. The 3500 foot channel would have enough impact on the valley hydraulics and valley storage to increase the expected peak discharges downstream of Dixie Highway. The increase is not large but would result in an increase of flood stages of 0.1 ft to 0.2 ft.

The shorter channel reaches start at station B0300 and go downstream. Here the channel would be located on the far side of the existing channel such that no existing trees in back yards or on the streambank closest to the houses would be removed.

The 750 foot channel would reduce flood stages by 0.5 to 1.0 foot for a 1000 foot length. This would reduce valley storage in this reach but downstream discharges would not increase enough to cause a 0.1 foot rise in floodwater elevations.

Reservoir 8

Components: The excavation of 57,260 cubic yards of material from the 10(floodplain of East Branch Butterfield Creek south of the EJ&E Railroad tr and west of Governor's Highway. The overflow would still enter the Gover Highway underpass at the railroad tracks. This component would be combin with the EJ&E Channel on the north side of the railroad tracks and the ra of the Governor's Highway Dike. The EJ&E Channel takes overflows at elev 699.0 back to the existing reservoir along the East Branch of Butterfield Creek north of the EJ&E railroad tracks.

Costs: The total cost of this measure including the EJ&E Channel and the raised dike is $498,400 with average annual costs estimated to be $46,000 which includes OM&R of $1760.

Effects: This reservoir would provide temporary storage of an additional 2 acre-feet of runoff below elevation 702.0. Total storage @ 702.0 equals 4 acre-feet. The 100 year peak discharge at the EJ&E railroad for future ru conditions would increase from 1500 to 1505 cfs. The 100 year water surfa elevation south of the EJ&E tracks would be reduced from 704.0 to 703.1. total of 15 acres of grassland and woodland would be dedicated to reservoi storage usage. Average annual damages in the East Branch Butterfield Creel area would be reduced by $26,800. This includes the benefits from EJ&E Channel and the Governor's Highway Dike.

The benefit/cost ratio for this element is 0.60:1.

Reservoir 9A

Components: The excavation of 39,500 cubic yards of material from the 100 y floodplain of East Branch Butterfield Creek north of the EJ&E Railroad and near the existing detention pond. This measure would be in combination witl the EJ&E Channel and the Governor's Highway Dike to compensate for the loss temporary storage associated with the EJ&E channel.

The EJ&E channel would take overflows from the Governor's Highway underpass elevation 699.0 and carry the water back to the existing reservoir area alon the East Branch of Butterfield Creek north of the EJ&E railroad tracks.

Costs: The total cost of this measure including the EJ&E Channel and the Governor's Highway Dike is $449,200 with average annual costs of $41,500 whi includes OM&R of $1620.

Effects: This reservoir would provide an additional 18 acre/feet of storage between elevation 696.0 and 700.0. Total storage added below the 100 year tion of 702.4 is 22.5 acre feet. The 100 year peak discharge at tracks would go down about 15 cfs from 1300 cfs to 1285 cfs.

acres of land presently platted for development but in the 100 set aside for storage of floodwater. Existing flood would be maintained or reduced with the 's the EJ&E Channel and the Governor's ges in the East Branch Butterfield Creek This includes the benefits from the EJ&E Dike.

ement is 0.65:1.

Reservoir 16

Components: The excavation of 513,000 cubic yards from the 100 year floodplain increasing the size of an existing reservoir, north of the EJ&E tracks and west of Governor's Highway along the East Branch of Butterfield Creek. This reservoir would be in combination with the EJ&E Channel that takes overflows from the Governor's Highway underpass at elevation 698.0 and conveys them to this reservoir along the north side of the railroad tracks.

Costs: The total cost of this measure including the EJ&E Channel is $2,944,200 with average annual costs estimated to be $264,000 which includes OM&R of $2700.

Effects: This reservoir along with existing storage would provide 410 acre/feet of flood storage below elevation 700.0. The 100 year peak discharge at the Conrail tracks for future runoff conditions would be reduced from 1300 to 1085cfs. A total of 41 acres of grassland and woodland would be dedicated to reservoir storage usage. Average annual damages along the East Branch Butterfield Creek would be reduced by $56,800. Additional benefits downstream on the main channel total approximately $11,000 annually. These total benefits of $67,800 include the benefits from the EJ&E Channel.

The estimated benefit/cost ratio = 0.26:1.

Governor's Highway Dike

There is an existing dike located along the east side of Governor's Highway just north of the EJ&E Railroad. This dike now overtops during the 20% or 5 year frequency flood. The top of the present dike is at elevation 701.9.

Components: The work consists of raising the dike from 701.9 to 703.0 and extending the dike approximately 300 feet to the north. The new dike would have a 12 foot top width and 3 to 1 side slopes. The total length of the new dike would be 700 feet. Total earthfill required would be approximately 600 cubic yards.

Costs: The cost of this measure is $28,000 with average annual costs estimated to be $2800 which includes $300 for OM&R.

Benefits: This measure in combination with the EJ&E Channel reduces the frequency the dike would be overtopped from once in 4 - 5 years to once in 100 years. Annual damages in the area east of Governor's Highway will be reduced by $26,800 with the installation of these 2 measures. The installation of these two measures will reduce the temporary storage in the floodplain by approximately 18 to 20 acre/feet. Based on current ordinances and the hydraulic evaluation it is assumed that this much storage would be constructed near the EJ&E Railroad to assure no change in downstream hydrologic conditions when the dike and channel are constructed. Either Reservoir 8 or Reservoir 9A described in this report would compensate for this loss of temporary storage.

The combined benefit/cost ratio for the dike, EJ&E Channel, and one of the Reservoirs will be less than 0.65 to 1.

EJ&E Channel

Components: The excavation of 5,120 cubic yards when in combination wit Reservoir 8 and the excavation of 5,430 cubic yards when in combination Reservoir 16. This channel would be located on the north side of the E tracks starting west of the Governor's Highway underpass and proceeding for 685 feet to the existing reservoir.

This channel is trapezoid in shape with a 40 foot bottom width, 4:1 sid slopes and has a 50 foot level section near Governor's Highway at elevat 699.0. The slope of the channel from the level section to the existing reservoir is 0.0079 ft/ft. The lower 470 ft of the channel would have a foot wide rock riprapped center section.

Costs: The total cost of this measure when combined with Reservoir 8 or $118,200 with average annual costs estimated to be $11,200 which include of $710. The total cost of this measure when used with Reservoir 16 is $119,400 with average annual costs estimated to be $11,300 which includes of $710.

Effects: This channel when combined with Reservoir 8 or 9A would allow overflows above elevation 699.0 at the Governor's Highway underpass to be conveyed west toward the existing reservoir along the East Branch of Butterfield Creek. This channel when combined with Reservoir 16 would al overflows above elevation 698.0 at the Governor's Highway underpass to be conveyed west toward the existing reservoir that has been expanded in size The 100 year peak discharge at the EJ&E railroad for future conditions wou be increased from 1500 to 1505 cfs with the Reservoir 8 combination and fr 1500 to 1550 cfs with the Reservoir 9A or 16 combination. A total of 1 ac of grassland would be dedicated to bypass channel usage. Average annual damages in the East Branch Butterfield Creek would be reduced by $26,800 w the Reservoir 8 or 9A combination and reduced by $56,800 with the Reservoi combination. Benefit/cost ratio for this increment by itself was not calculated because it would increase downstream discharges unless construct with a reservoir like 8, 9A, or 16.

The channel reduces the depth and frequency of flooding in the 217th Street area.

ALTERNATIVES FOR FLOODPLAIN MANAGEMENT

Several floodplain management strategies were evaluated including a) no action, b) nonstructural measures, c) structural measures, and d) a combination of measures. A brief description of the alternatives follows: (See Appendix C for sketches of the different structural measures and Appendix D for cost details.) Since none of the structural measures were incrementally feasible, this section does not include an alternative with structural measures.

Alternative A - Future Without Project (No Action)

Components: This alternative assumes no additional action beyond what is currently being done in the watershed. All new development will be regulated by the communities, Cook County or Will County. The new development will need to meet the existing on-site detention ordinances. These ordinances require all new development to provide approximately 1.5 inches of storage for the area being developed with a release rate of about 0.5 cfs/acre. Compensatory storage will be provided for any development in an identified floodplain. Existing homeowners in floodprone areas will continue to purchase flood insurance to reduce the financial impact of flooding. Areas currently experiencing flood damages will continue to experience flood damages.

Costs: The costs of this alternative will be determined by the number of individuals who purchase flood insurance ($250 + per household per year) and the costs to the local governments for implementation of floodplain regulations.

Effects: The average annual damages will increase as peak discharges increase somewhat in response to the additional development with on-site detention. A total of 147 buildings will still be flooded by the 1% chance flood. Some existing home owners and business owners may attempt to relocate due to the uncertainty of when their property will be damaged. The communities involved will continue to receive complaints about flooding and will be monitoring flood levels on Butterfield Creek and Tributaries during all storm events. It is estimated average annual damages to buildings will be over $200,300 per year in 2005. Other estimated average annual damages are $5000 for traffic disruption and $25,000 to the three golf courses.

Alternative B - Nonstructural Measures

Components: The primary components consist of administrative actions su zoning, on-site detention requirements, building codes or flood insuranc non-structural measures such as a flood warning system, floodproofing wh includes low dikes or fills, and sewer check valves. All local governme the detailed study area are currently cooperating with the National Floo Insurance Program and flood insurance is available for all residents of floodprone areas shown on the floodplain maps. The maps and profiles pre as part of this report are provided for possible revision of the regulato maps for the areas involved. It is estimated that 40 homeowners would be willing to construct flood protection (floodproofing) measures consisting low fills of 15 inches or less around their houses and raising existing w wells for the lower story of their homes. These measures will reduce frequency of flooding by keeping water out of basements until water reach the 4% chance flood level or first floor, whichever is lower. Many of th existing homeowners have already installed check valves on their sewer li to prevent sewer backup. The IDOT Division of Water Resources is conside the funding of the engineering services required to determine type of floodproofing required. Floodwater elevations and first floor elevation c has been provided to IDOT Division of Water Resources and to each communit the identified floodplain.

Costs: It is estimated that flood insurance will cost the same as the no action situation, approximately $250/building. The floodproofing of homes would cost $128,000 with an estimated annual cost of $13,600 including $2,. annual O&M. The flood warning system would consist of monitoring Butterfie Creek and East Branch flows and warning floodprone areas when water is approaching bank full at various locations in the watershed. Estimated cos to do this is $3000 per year. The total installation cost of this alternat is $128,000 for floodproofing with an annual cost of $13,600 which includes OM&R.

Total annual cost including flood warning system = $16,600.

Effects: All residences subject to first floor damage by floodwater would have the peace of mind of knowing the flood insurance policies would cover them for damages over $200 in a given year. Most of the damages to basemen is not covered by flood insurance. The 40 properties where the floodproofi measures, consisting of 15 inches or less of fill and raising existing windo wells, are installed will see their annual damages reduced by a total of approximately $50,000 per year. All of these 40 properties will still be subject to damage by the 50, 100, and 500 year floods. A total of 147 buildings will still be subject to damage by the 1% chance (100 year) flood and 22 would still be subject to damage by the 10 year flood.

All residents who install the sewer check valves will reduce the worry and damages from sewer backup. Damages to property from sewer backup has not be estimated as part of this study.

floodproofing the 40 properties is 3.7:1.
ratio for this alternative is 3:1.

ges to buildings would be $150,300. The damages
lf courses ($25000) will remain the same as

Table 8
SUMMARY AND COMPARISON OF ALTERNATIVES 1/
FUTURE LAND USE (2005)

ITEM	ALTERNATIVE A	ALTERNATIVE B
Components	On-site detention, compensatory storage, floodplain regulation, flood insurance, sewer check valves	On-site detention, compensatory storage flood warning system, flood proofing 40 bldgs to 25yr flood level, sewer check valves
Total project installation cost	-	$128,000
Annual Cost 2/	-	16,600
Annual Benefits	-	50,000
Net Annual Benefits	-	33,400
Benefit/Cost Ratio		3.0:1
Remaining Building Damages	$200,300	150,300
Traffic Damage	5,000	5,000
Golf Course Damage	25,000	25,000
Number of Buildings flooded (100 yr)	147	
Number of Buildings flooded (10yr)	62	

1/ All costs, damages and benefits shown
2/ 100 year period 8 7/8%.

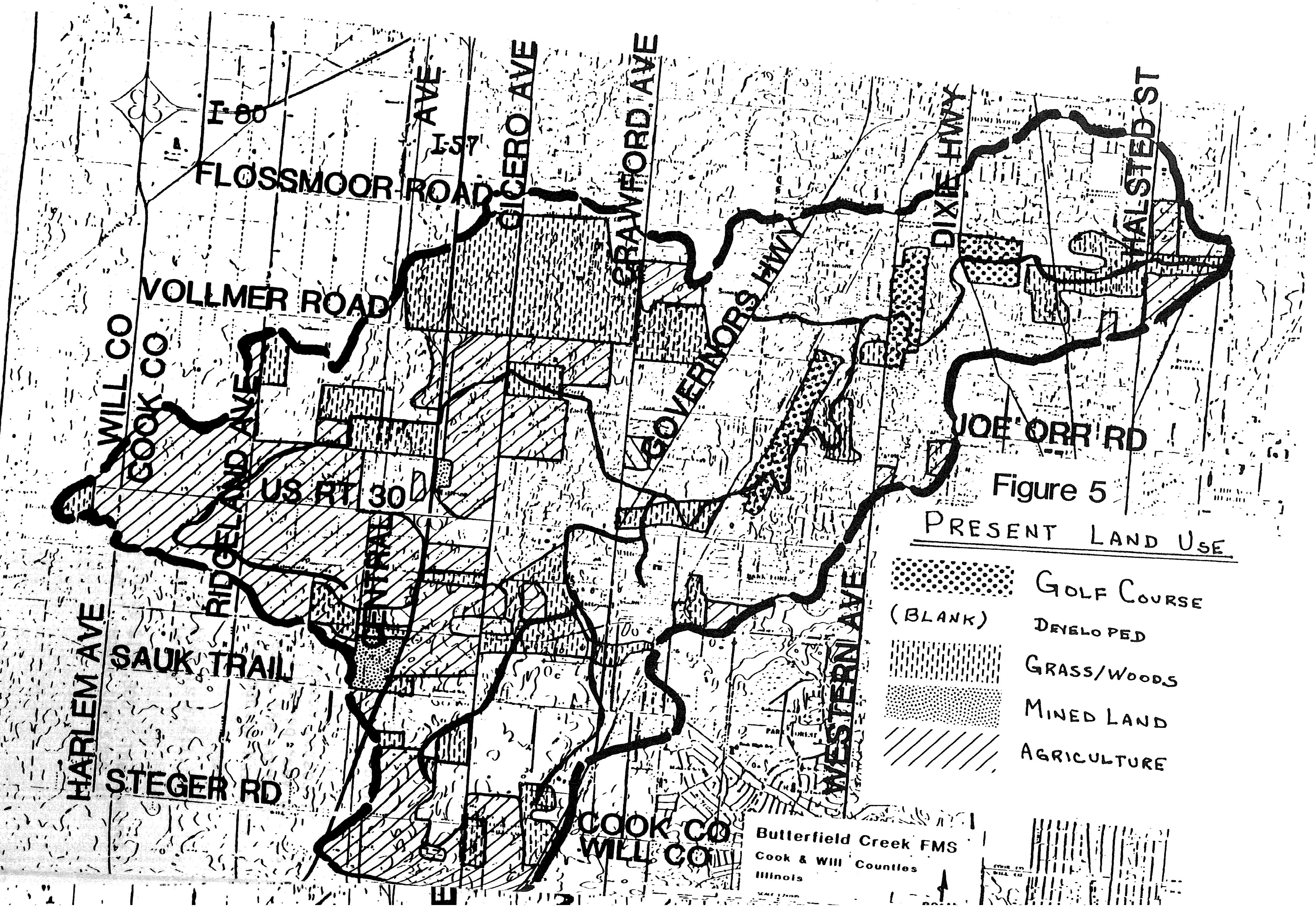


Figure 5
Present Land Use

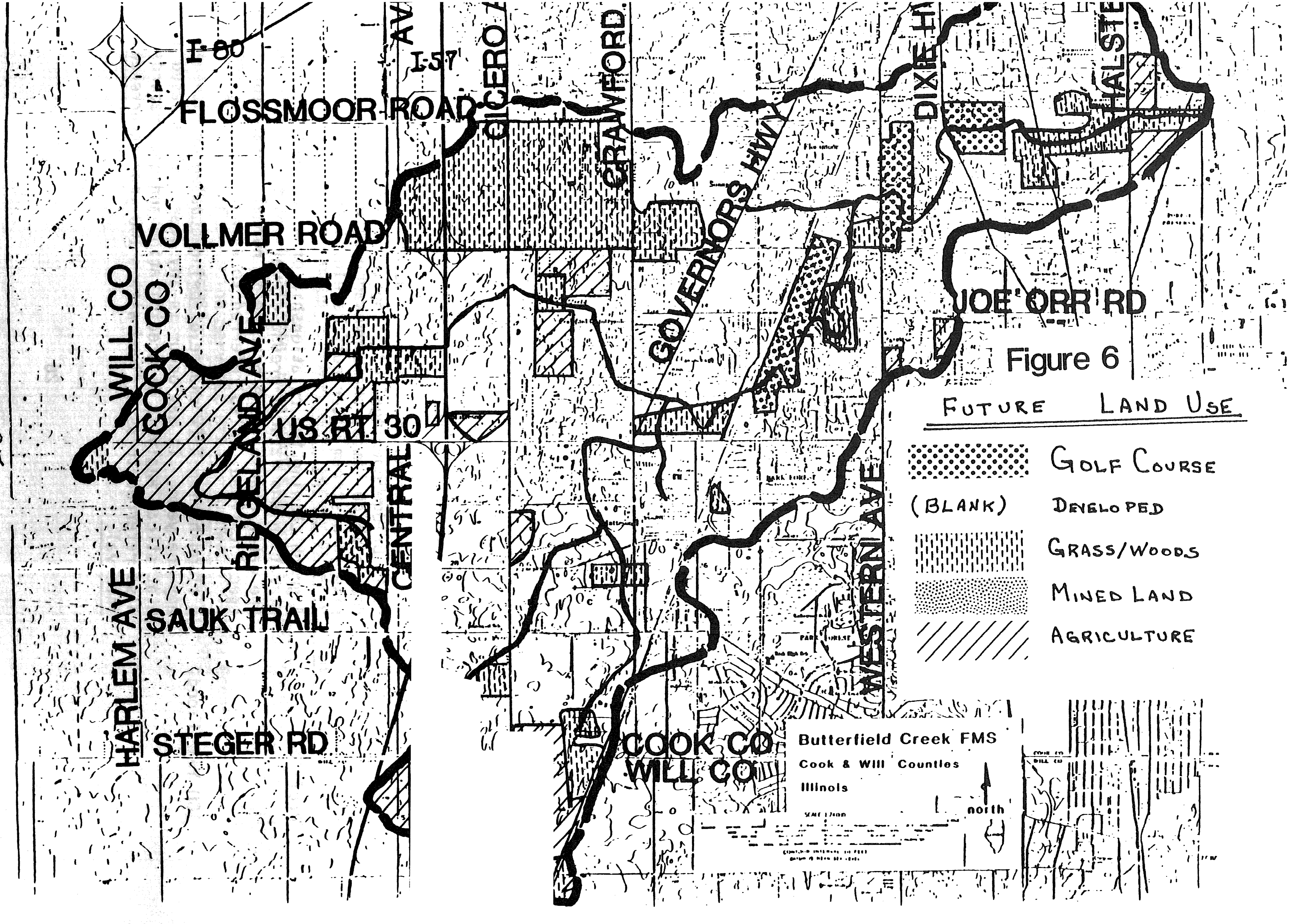


Figure 6
FUTURE LAND USE
GOLF COURSE
(BLANK) DEVELOPED
GRASS/WOODS
MINED LAND
AGRICULTURE
Butterfield Creek FMS
Cook & Will Counties
Illinois
north
I-80
I-57
FLOSSMOOR ROAD
VOLLMER ROAD
CICERO
CRAWFORD
GOVERNORS HWY
DIXIE H
HALSTE
JOE ORR RD
WESTERN AVE
CENTRAL
US RT 30
RIDGELAND AVE
SAUK TRAIL
STEGER RD
HARLEM AVE
WILL CO
COOK CO

GLOSSARY AND REFERENCES

GLOSSARY

Avg. Annual Damage- The estimated average yearly damage expected to o during the project evaluation periods.

Encroachment- Obstruction in part of a floodplain which reduces floodwater carrying capacity, therefore increasing stages.

Floodway- The portion of a floodplain required to convey flo without causing significant increases in flood he velocities.

Floodway Fringe Area- Portions of the floodplain outside of the floodway subject to shallow inundation and low velocity flow

Flood- An overflow of water onto land not normally covered water. This inundation of land is temporary, and th is normally adjacent to a river or stream, lake, or body of water. Normally, a "flood" is considered as temporary rise of stream flow or stage that causes a significant adverse effect. Adverse effects would b damage to property, sewer backup, creation of unsanit conditions, erosion, sedimentation, accumulation of debris, traffic disruption or other problems.

Flood Crest- The maximum stage or elevation reached by the waters o flood at a given location. It may be referred to as t <u>stage or high water elevation.</u>

Flood Peak- The maximum instantaneous discharge at a given locatio It usually occurs at or near the time of the flood cre

Floodplain- The relatively flat area or low lands adjoining the str channel, or water course, lake, or other body of water, which has or may experience flood inundation.

Head Loss- The effect of natural or man-made obstructions such as small bridge openings, buildings, fill, or accumulation debris which limits the conveyance of water, causing a rise in upstream water surface elevation.

Profile- A graph showing the relationship of water surface elevation and natural ground elevations to location alon the water course. The profile is normally drawn for a specific flood. Also referred to as <u>water surface profil</u>

100 Year Flood- A flood having a 1% chance of being equaled or exceeded i any one year. It may occur in any year. It is based on statistical analysis of precipitation and gage records. Also referred to as a flood with a 100 year <u>recurrence interval.</u>

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SUMMARY OF PEAK FLOWS AND ELEVATIONS
BY VALLEY SECTIONS
BUTTERFIELD CREEK

Map	Cross Section	Bottom Elev	2 Year Q	2 Year Elev	10 Year Q	10 Year Elev	100 Year Q	100 Year Elev	500 Year Q	500 Year Elev
1	none									
2	B0010	603.6	950	609.2	1720	611.9	2470	614.7	3725	615.C
2	B0023	606.8	950	612.1	1710	613.3	2750	615.2	3750	615.7
2	B0033	606.5	940	613.1	1710	614.4	"	616.0	3755	616.7
2	B0059	606.9	"	614.5	1700	615.6	2760	616.8	3790	617.5
4	B0089	610.2	935	617.4	"	618.8	"	620.4	"	621.8
4	B0114	610.2	"	617.9	"	619.3	2770	620.7	3850	622.1
4	B0124	613.0	930	619.8	1690	621.3	"	622.6	"	623.9
4	B0168	617.8	"	625.4	"	626.7	2790	627.8	3900	628.9
4	B0189	620.5	925	626.9	1685	628.3	2810	632.0	3945	632.8
4	B0208	624.0	"	629.7	1675	630.7	2800	632.9	3935	633.8
4	B0235	623.8	930	631.6	"	632.8	2805	634.5	"	635.5
4	B0244	625.5	"	632.6	1665	633.9	2790	635.5	3930	636.6
3	B0276	624.8	940	634.8	"	636.2	2785	637.4	"	636.6
3	B0281	627.0	"	635.1	"	636.5	2780	637.8	3925	638.6
3	B0287	627.8	945	635.6	1650	637.2	2775	638.7	3920	639.5
3	B0300	629.5	955	637.8	1685	639.2	2810	640.7	3960	641.6
6	B0313	630.7	965	638.7	1710	640.0	2860	641.5	3990	642.4
6	B0340	632.5	975	641.1	1730	642.4	2900	643.7	4050	644.7
6	B0366	635.6	985	643.5	1750	644.6	2935	645.8	4090	646.7
6	B0401	638.2	970	646.1	1730	646.9	2890	647.6	4040	648.4
6	B0421	639.0	960	647.3	1710	648.0	2870	648.8	4000	649.4
6	B0425	639.2	950	647.6	1690	648.4	2840	649.7	3955	650.6
6	B0428	639.0	925	647.9	1630	648.9	2750	650.4	3900	651.5
6	B0450	638.5	890	649.3	1540	650.8	2560	652.3	3525	653.2
6,5	B0454	642.5	885	650.0	1490	651.6	2520	652.5	3475	653.8
11	B0473	644.2	875	651.4	1470	652.5	2430	653.3	3400	654.4
11,10	B0484	645.2	870	652.3	1445	653.6	2350	655.5	3300	656.5
10	B0516	650.8	"	656.3	1460	657.0	"	658.0	"	658.7
10	B0552	653.0	860	660.2	"	660.9	"	661.7	"	662.2
15	B0561	653.3	860	661.2	1480	662.7	2350	663.6	3275	664.2
15	B0592	657.1	870	662.9	"	663.8	2355	664.7	3250	665.4
15	B0624	658.8	875	665.9	1490	666.9	"	667.7	3225	668.4
15	B0646	659.3	"	666.8	"	667.7	2350	668.4	3200	669.1
20	B0666	660.0	"	667.7	"	668.7	2300	669.6	3150	670.3
15,20	B0716	665.8	"	671.7	1480	672.4	2260	673.2	3100	673.8
20	B0726	664.3	880	672.5	"	673.2	2220	673.9	3050	674.5
20	B0747	667.3	"	674.7	1470	676.6	2200	679.3	3000	682.2
10				676.0	"	677.7	2180	680.3	2900	682.4
				677.7	1460	679.0	2140	681.0	2850	682.8
				679.8	"	681.1	2100	682.8	2800	684.4
				681.7	1440	683.0	2040	684.2	2700	685.5
				82.0	515	683.2	835	684.5	1050	685.7
				3	"	683.3	"	684.7	"	685.9
					"	683.6	820	684.9	1040	686.1

SUMMARY OF PEAK FLOWS AND ELEVATIONS
BY VALLEY SECTIONS
BUTTERFIELD CREEK

	Cross	Bottom	2 Year		10 Year		100 Year		500 Year	
ap	Section	Elev	Q	Elev	Q	Elev	Q	Elev	Q	Elev
9	B0877	675.1	300	682.5	510	683.7	810	685.0	1020	686.1
9	B0880	677.6	"	682.6	505	683.9	800	685.2	1000	686.6
9	B0900	676.6	"	684.4	500	685.9	780	687.7	980	688.8
4	B0916	679.5	"	686.0	490	687.7	770	689.2	960	689.9
4	B0933	680.7	290	687.4	485	689.2	760	691.4	940	692.1
4	B0946	680.8	290	687.9	480	689.6	740	691.6	920	692.3
4	B0958	681.6	"	688.6	475	690.2	700	691.8	900	692.4
,14	B0988	682.6	"	690.1	470	691.5	680	692.6	820	693.1
	B1030	683.5	265	691.6	405	693.0	540	693.9	620	694.4
	B1047	684.1	"	692.2	"	693.6	"	694.6	"	695.0
3,8	B1065	684.7	260	692.6	380	694.0	520	694.9	590	695.3
3	B1108	685.7	250	693.9	360	695.2	490	696.0	570	696.3
3	B1113	685.7	230	694.0	350	695.3	470	696.0	540	696.4
3	B1121	686.1	"	694.1	"	695.4	"	696.3	"	696.7
3	B1133	685.5	"	694.7	"	695.9	"	696.7	"	697.0
3	B1150	687.0	230	694.8	350	696.0	470	696.7	540	697.1
3	B1161	687.6	"	694.9	"	696.1	"	696.8	"	697.2
3,17	B1204	687.6	535	695.3	855	696.3	1270	697.0	1640	697.3
2,17	B1228	689.3	390	696.4	650	697.2	1015	697.8	1270	698.1
2,17	B1250	689.9	320	696.7	580	697.6	930	698.2	1140	698.6
6	B1289	692.3	300	698.9	545	699.3	900	700.0	1120	700.2
6	B1302	694.2	280	699.9	490	700.7	795	701.8	960	702.4
6,21	B1333	695.4	170	700.4	440	701.5	725	702.9	900	703.5
1	B1376	697.4	165	702.2	280	703.1	435	703.9	530	704.2
1	B1420	698.0	145	704.0	255	705.3	375	706.4	450	706.8
1	B1436	698.7	135	704.5	225	706.0	340	706.9	400	707.3
1	B1444	699.4	105	704.7	170	706.1	245	707.3	295	707.7
1,22	B1466	699.4	60	704.8	90	706.2	120	707.3	140	707.8
2,25A	B1488	699.5	60	705.0	90	706.3	120	707.4	"	"

SUMMARY OF PEAK FLOWS AND ELEVATIONS
BY VALLEY SECTIONS

EAST BRANCH BUTTERFIELD CREEK

Map	Cross Section	Bottom Elev	2 Year Q	2 Year Elev	10 Year Q	10 Year Elev	100 Year Q	100 Year Elev	500 Yea[r] Q	500 Yea[r] Ele[v]
19	BET009	676.2	615	683.0	1005	684.1	1405	685.3	1715	686
19	BET020	678.4	"	684.0	1000	685.1	1400	686.1	1710	687
19	BET026	678.0	610	684.7	"	686.1	"	687.3	"	688
19,24	BET038	678.7	"	686.0	995	687.3	"	688.5	1705	689
19,24	BET043	679.1	"	686.2	"	687.6	1395	688.8	"	689.
24	BET048	678.9	605	686.4	990	688.1	1390	689.6	1700	690.
19	BET059	682.2	"	687.7	"	689.1	"	690.2	"	691.
19	BET072	683.5	"	689.5	980	690.8	"	692.1	"	693.
19	BET075	683.6	"	690.6	"	692.2	1380	693.4	1695	694.
19	BET085	683.9	600	692.3	"	693.6	1370	694.5	1690	695.
19	BET092	685.0	595	692.6	975	693.9	1365	694.8	1685	695.4
18	BET097	685.2	590	692.8	970	694.1	1360	695.0	1675	695.7
18	BET100	686.8	"	692.8	"	694.3	1350	695.5	1670	696.4
24	BET103	686.5	585	693.1	950	694.5	1340	695.6	1650	"
24	BET118	687.3	580	693.5	930	694.7	1320	695.8	1610	696.6
24	BET140	690.9	570	696.3	915	697.2	1300	697.8	1595	698.2
24	BET152	"	560	697.1	905	697.9	1280	698.5	1580	698.9
24	BET158	691.6	555	698.7	900	700.9	1270	701.8	"	702.2
24	BET168	689.0	"	699.4	"	701.3	1280	702.3	1600	702.8
26	BET184	693.0	625	699.4	1330	701.3	2030	702.3	2450	702.8
26	BET205	693.0	320	699.4	690	701.3	1230	702.3	1540	702.8
26	BET214	693.9	"	699.7	"	701.4	"	702.4	"	702.9
26	BET216	697.5	320	701.5	690	702.5	1230	703.4	1540	704.0
26	BET226	698.5	"	701.7	"	702.6	"	703.6	"	704.2
26	BET236	700.5	335	702.7	720	703.5	1200	704.3	1530	704.7
26	BET241	697.6	330	702.8	700	703.7	1170	704.4	1490	704.8
26	BET245	700.5	330	703.0	680	703.9	1130	704.6	1430	705.0
28	BET255	700.8	325	704.1	670	704.7	1130	705.3	1400	705.6
28	BET272	700.6	320	704.8	660	705.6	1050	706.2	1370	706.6
28	BET278	699.1	"	705.1	650	705.9	1070	706.6	1350	707.1
28	BET295	702.1	315	708.2	650	708.7	1055	709.0	1330	709.3
28	BET303	704.0	"	709.8	640	710.5	1030	710.9	1310	711.1
28	BET309	705.9	310	711.0	620	711.7	1015	712.1	1290	712.3
30	BET324	711.1	300	712.0	600	713.5	1000	714.5	1270	714.8
30	BET341	715.1	290	718.5	580	719.5	950	720.3	1270	720.8
30	BET375	719.0	280	724.8	565	725.9	915	726.8	1150	727.2
30	BET380	724.3	220	727.1	420	727.8	660	728.4	820	728.7
30	BET384	727.1	"	729.4	"	729.7	"	730.0	"	730.2
31	[illegible]		)	732.5	340	733.0	"	733.4	670	733.6
				739.0	"	739.5	"	739.9	"	740.2

ns for the ponding area north of EJ&E Railroad
y are as follows: 2 years = 701.4, 10 year =
500 year 703.6

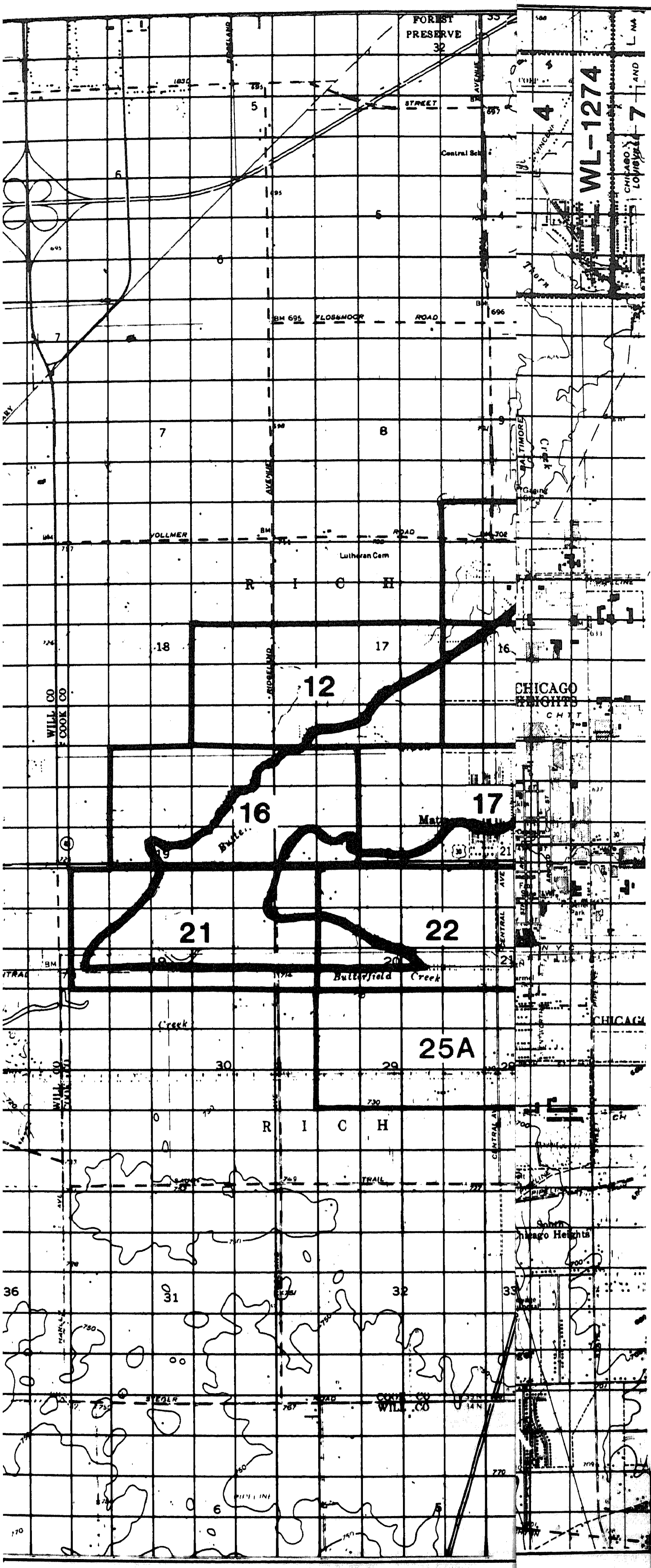
SUMMARY OF PEAK FLOWS AND ELEVATIONS BY VALLEY SECTIONS

TRIBUTARY TO EAST BRANCH

Map	Cross Section	Bottom Elev	2 Year Q	2 Year Elev	10 Year Q	10 Year Elev	100 Year Q	100 Year Elev	500 Year Q	500 Year Elev
26	TEB004	693.2	350	699.5	680	701.4	880	702.3	1000	702.8
26	TEB026	694.4	340	700.3	660	702.0	860	703.0	980	703.5
25	TEB061	697.0	"	703.0	"	704.1	840	704.7	970	705.1
25	TEB073	700.3	325	704.9	"	707.0	1150	710.8	1390	712.0
27	TEB110	704.4	250	708.9	470	710.6	710	711.5	800	712.6
27	TEB125	706.2	240	710.4	460	712.1	690	713.5	780	714.2
27	TEB129	710.0	"	716.0	"	717.8	"	718.9	"	719.2
29	TEB173	709.0	285	720.0	485	721.6	700	723.0	765	725.2
29	TEB181	716.0	345	720.8	560	722.0	800	724.2	1100	725.8
29	TEB199	720.5	280	727.9	490	729.5	740	729.9	950	730.1
29	TEB220	724.0	250	728.9	460	730.5	700	730.7	880	731.0

FLOSSMOOR TRIBUTARY

5	FT023	652.7	143	655.3	157	655.5	170	655.6	175	655.8
5	FT028	653.2	"	656.8	"	656.8	"	656.9	175	656.9
5	FT033	654.8	"	658.7	"	658.7	"	658.8	"	658.8
5	FT040	657.0	"	667.7	"	669.8	168	671.4	173	672
5	FT050	662.1	260	668.2	500	670.1	795	671.7	990	67
5	FT060	667.3	"	671.9	"	672.9	"	673.9	"	67
5	FT079	674.2	210	679.3	460	680.6	760	681.5	950	6
5	FT088	677.9	190	684.1	440	684.5	740	685.8	890	6
5	FT092	683.5	190	687.1	"	687.8	"	688.5	"	6
5	FT107	688.0	180	693.2	420	693.5	720	693.7	"	6



CONTOUR INTERVAL 5 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

LEGEND
- HORIZONTAL CONTROL STATION
- HORIZONTAL CONTROL STATION (TARGETED)
- BRIDGING POINT
- FIELD VERTICAL POINT

ORTHOPHOTOGRAMMETRIC MAPPING

: OF PHOTOGRAPHY: APRIL 26,1984 CONT

: OF MAPPING: OCTOBER 1984 DATUM: N.

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BUTTERFIELD CREEK FLOODPLAIN MAPS

1986

INDEX MAP

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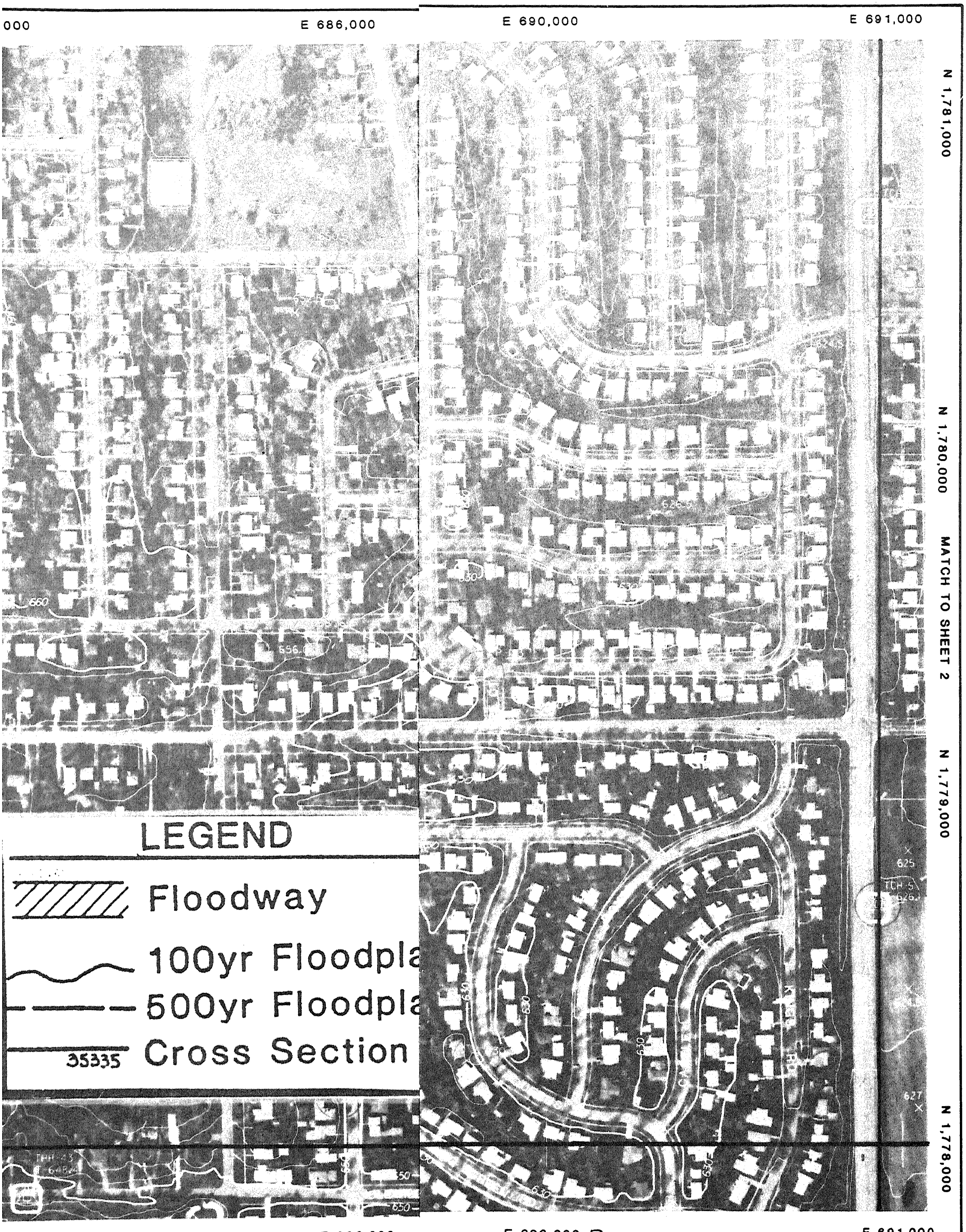

PRESENT CONDITIONS

BUTTERFIELD CREEK
FLOODPLAIN MAP
1986

SHEET 1 OF 31

LEGEND

ORTHOPHOTOGRAMMETRIC MAPPING

PHOTOGRAPHY: APRIL 26,1984 CONTO

MAPPING: OCTOBER 1984 DATUM: N.G

SCALE IN FEET

200 0 200 400 600 800

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PRESENT CONDITIONS

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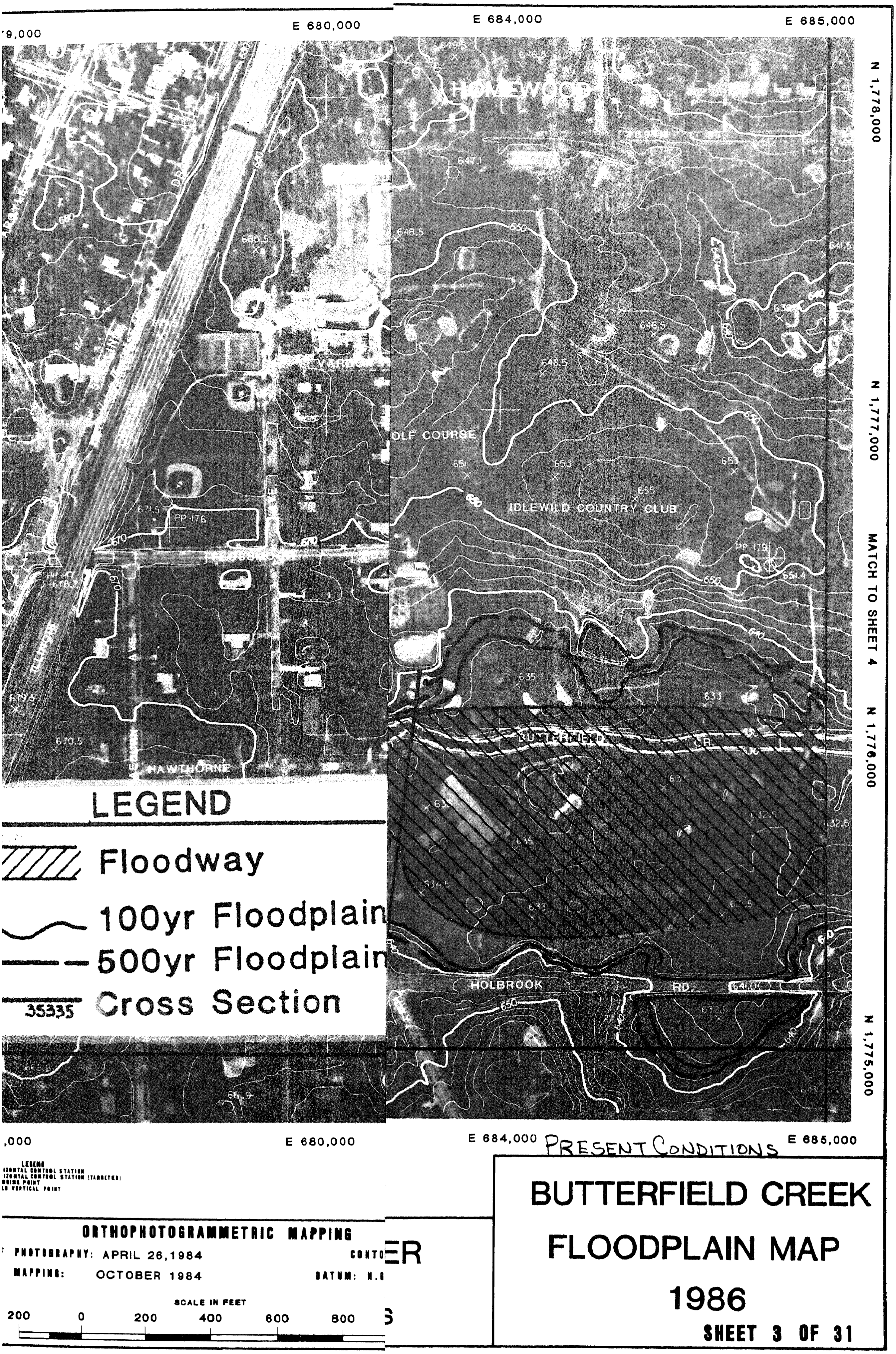
LITTLE CALUMET RIVER BASIN
WILL AND COOK COUNTIES

BUTTERFIELD CREE
FLOODPLAIN MAP



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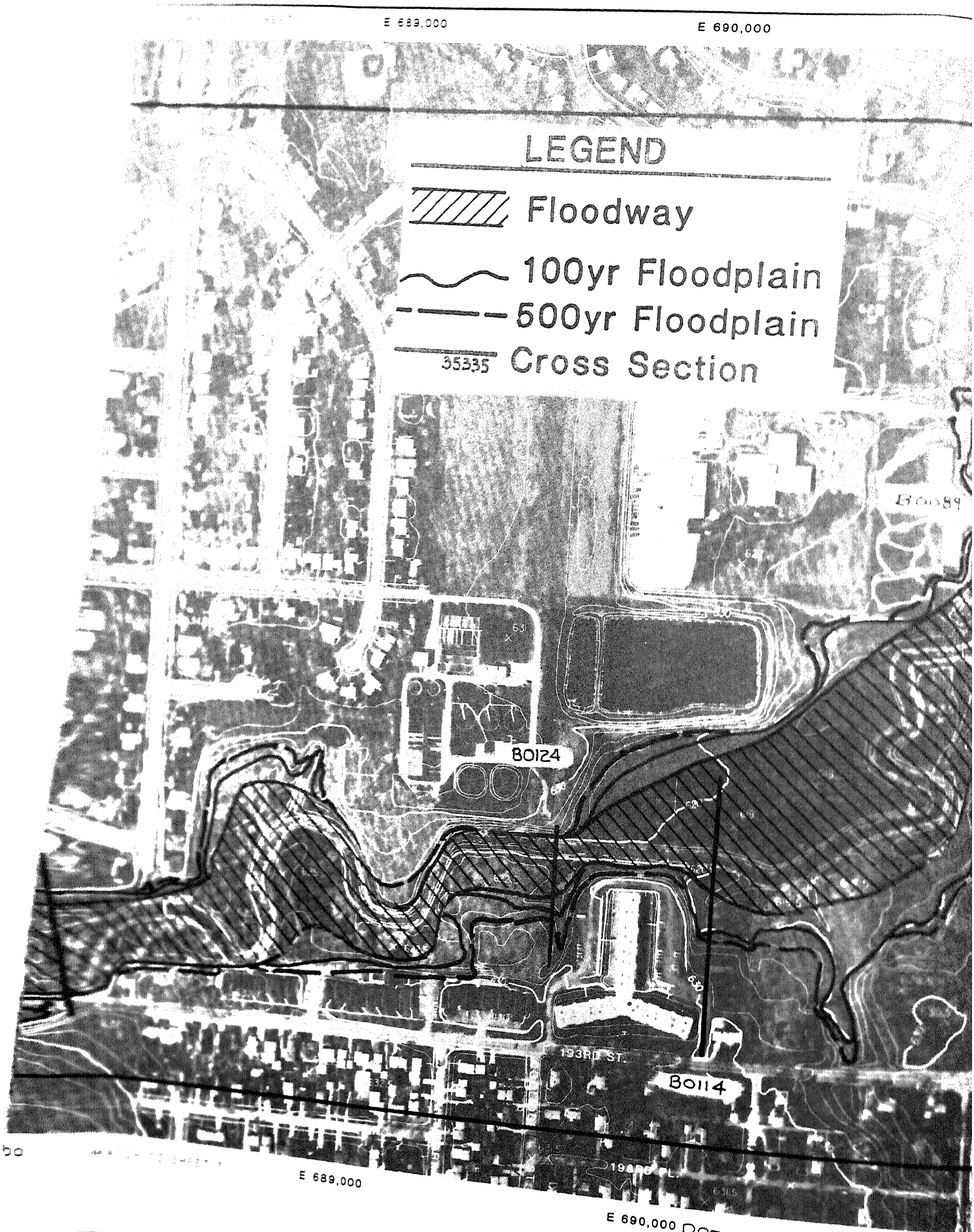
E 684,000
E 685,000
N 1,778,000
N 1,777,000
N 1,776,000
N 1,775,000
MATCH TO SHEET 4
HOMEWOOD
OLF COURSE
IDLEWILD COUNTRY CLUB
BUTTERFIELD CR.
HOLBROOK RD.
HAWTHORNE
ILLINOIS
LEGEND
Floodway
100yr Floodplain
500yr Floodplain
Cross Section
35335
ORTHOPHOTOGRAMMETRIC MAPPING
PHOTOGRAPHY: APRIL 26, 1984
MAPPING: OCTOBER 1984
SCALE IN FEET
200 0 200 400 600 800
PRESENT CONDITIONS
BUTTERFIELD CREEK
FLOODPLAIN MAP
1986
SHEET 3 OF 31



PRESENT CONDITIONS

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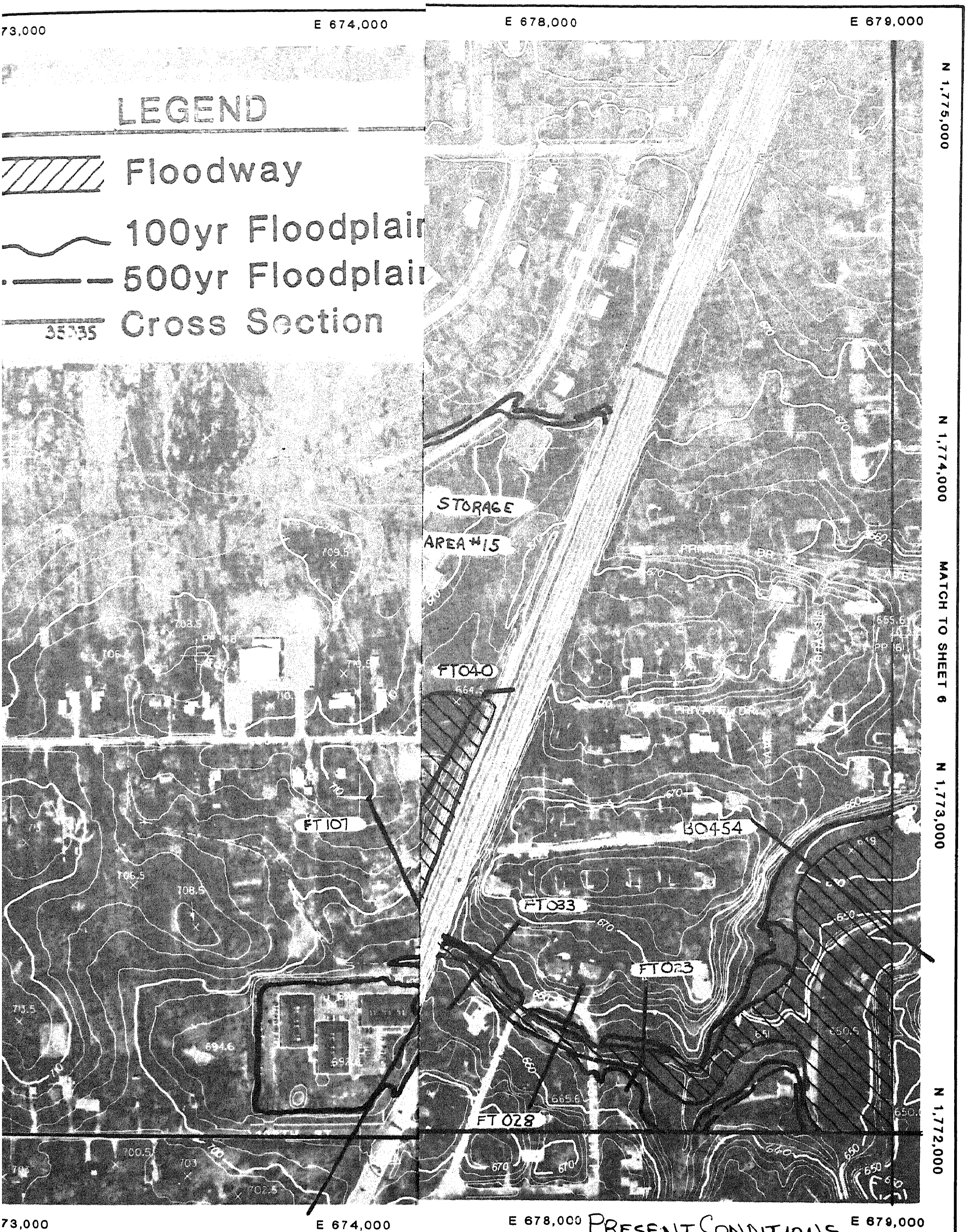
LITTLE CALUMET RIVER
BASIN
WILL AND COOK COUNTIES

BUTTERFIELD CRE
FLOODPLAIN MA



PRESENT CONDITIONS

LEGEND
ORIZONTAL CONTROL STATION
ORIZONTAL CONTROL STATION (TARGETED)
IDDING POINT
ELD VERTICAL POINT

ORTHOPHOTOGRAMMETRIC MAPPING

F PHOTOGRAPHY: APRIL 26,1984 CONT
F MAPPING: OCTOBER 1984 DATUM: N.G

SCALE IN FEET
200 0 200 400 600 800

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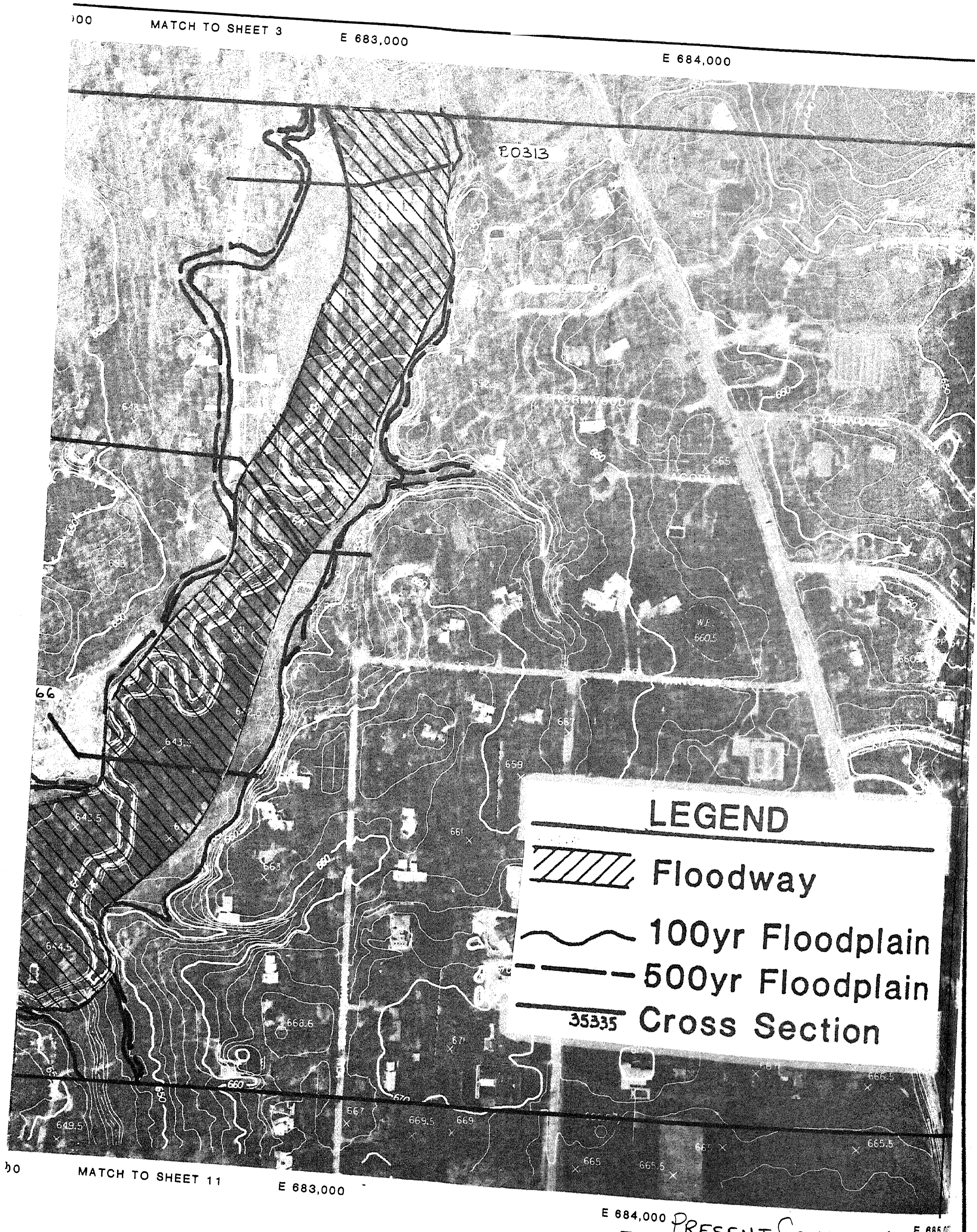
BUTTERFIELD CREEK FLOODPLAIN MAP 1986

SHEET 5 OF 31



RTATION
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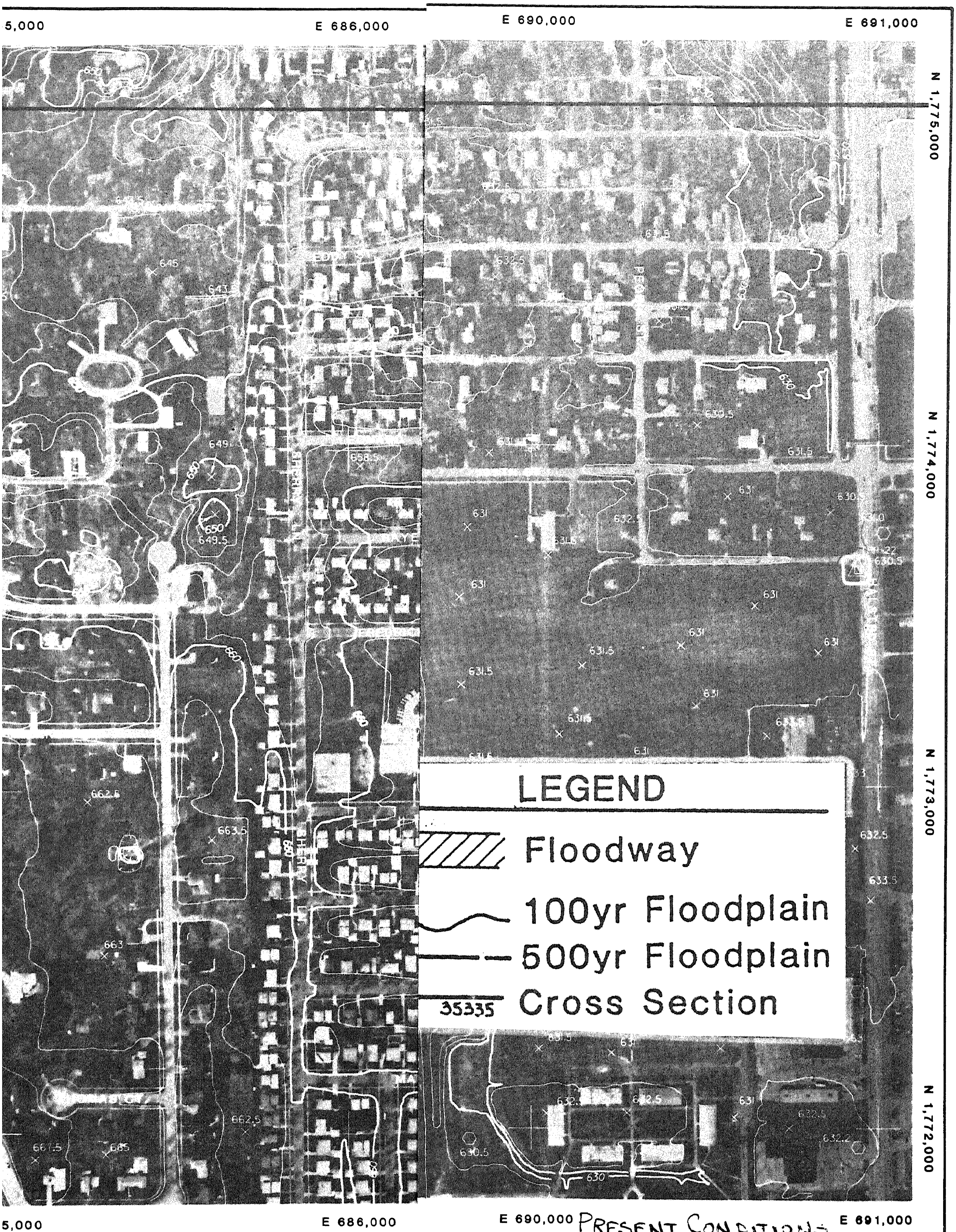
CT NO.
1321

LITTLE CALUMET RIVER BASIN
WILL AND COOK COUNTIES

BUTTERFIELD CREEK FLOODPLAIN MAP
1986

SHEET 6 OF 31



BUTTERFIELD CREEK FLOODPLAIN MAP 1986

SHEET 7 OF 31

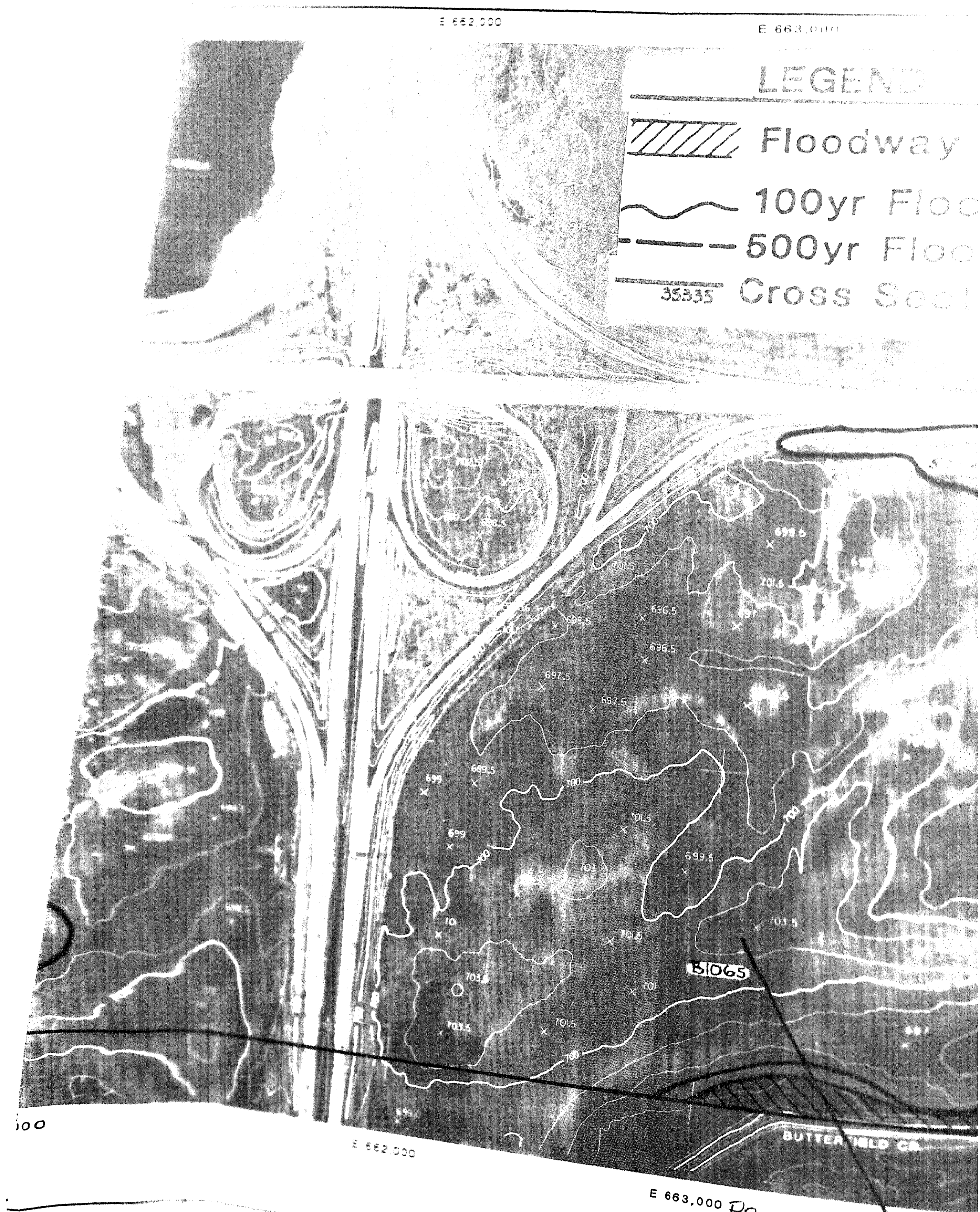
ORTHOPHOTOGRAMMETRIC MAPPING

PHOTOGRAPHY: APRIL 26,1984 **CONTO**

MAPPING: OCTOBER 1984 **DATUM: N.G.**

SCALE IN FEET

200 0 200 400 600 800



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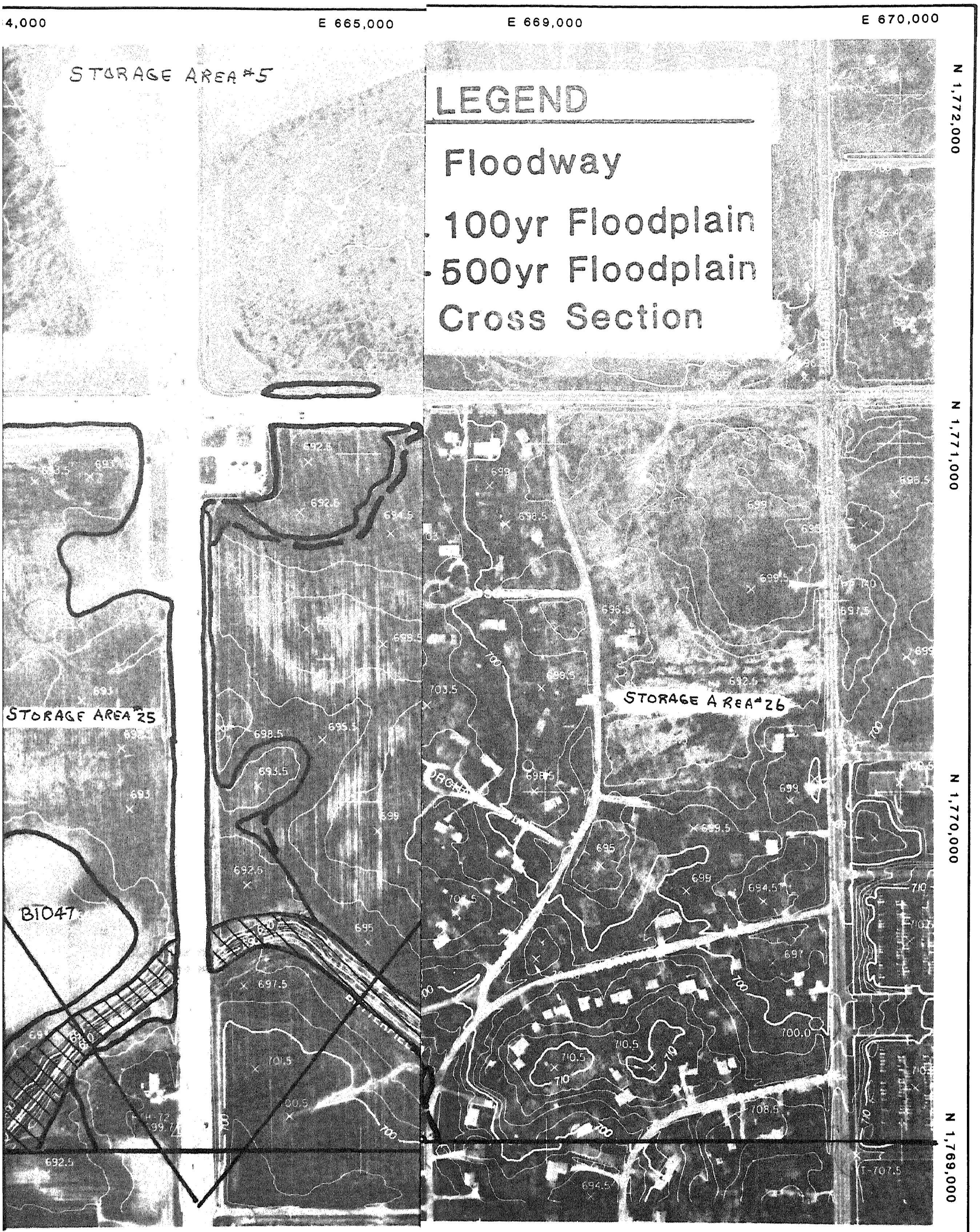
LITTLE CALUMET RIVER
BASIN
WILL AND COOK COUNTIES

BUTTERFIELD C
FLOODPLAIN
1986



PRESENT CONDITIONS

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E 669,000

E 670,000

BUTTERFIELD CREEK FLOODPLAIN MAP 1986

LEGEND
ZONTAL CONTROL STATION
ZONTAL CONTROL STATION (TARGETED)
SING POINT
VERTICAL POINT

ORTHOPHOTOGRAMMETRIC MAPPING

PHOTOGRAPHY: APRIL 26,1984 CONT

MAPPING: OCTOBER 1984 DATUM: N.

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SCALE IN FEET

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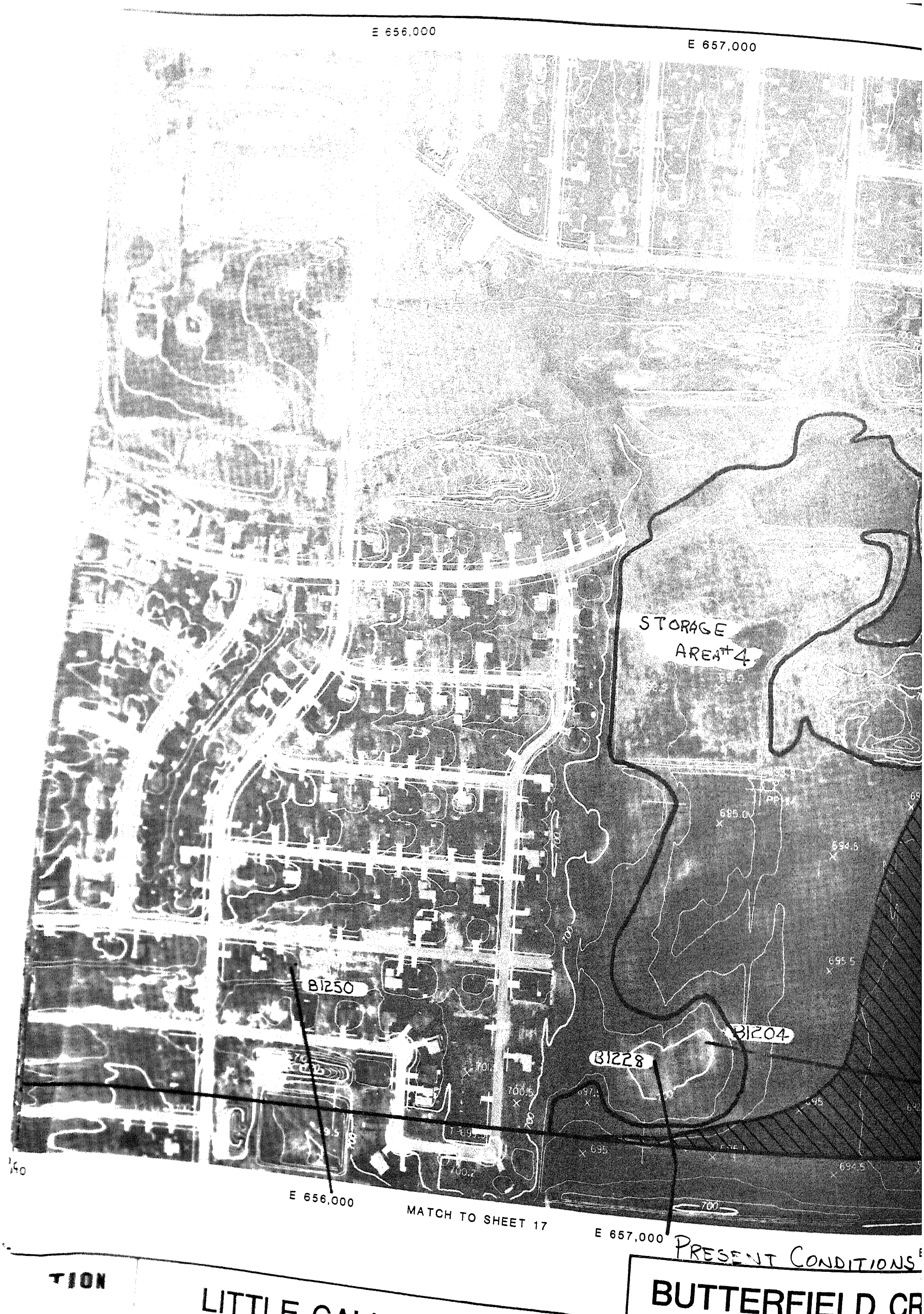

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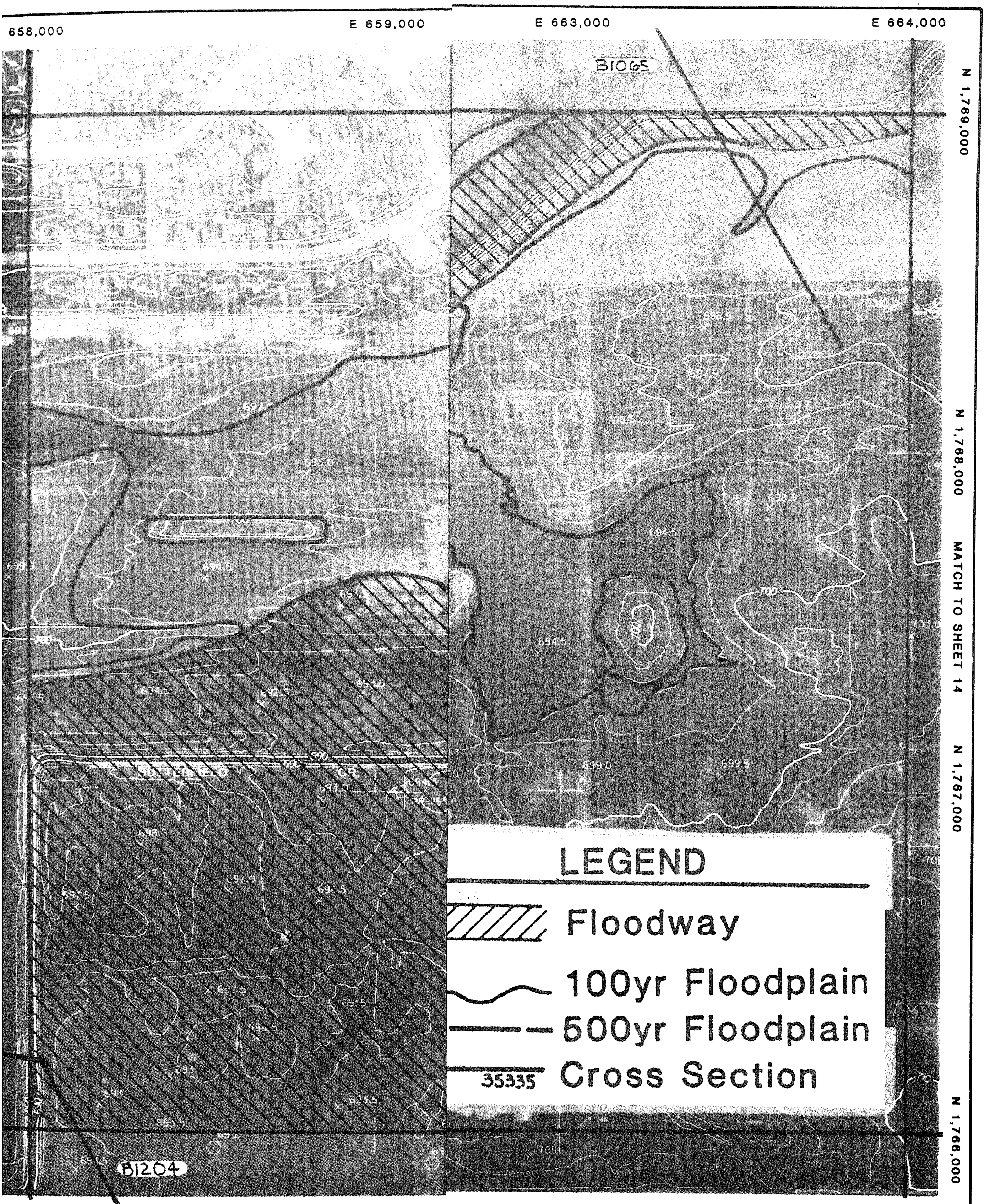
LITTLE CALUMET RIVER
BASIN
WILL AND COOK COUNTIES

BUTTERFIELD CR
FLOODPLAIN M
1986

SHEET 12 O



PRESENT CONDITIONS

ORTHOPHOTOGRAMMETRIC MAPPING

E OF PHOTOGRAPHY: APRIL 26,1984

E OF MAPPING: OCTOBER 1984

CONTO

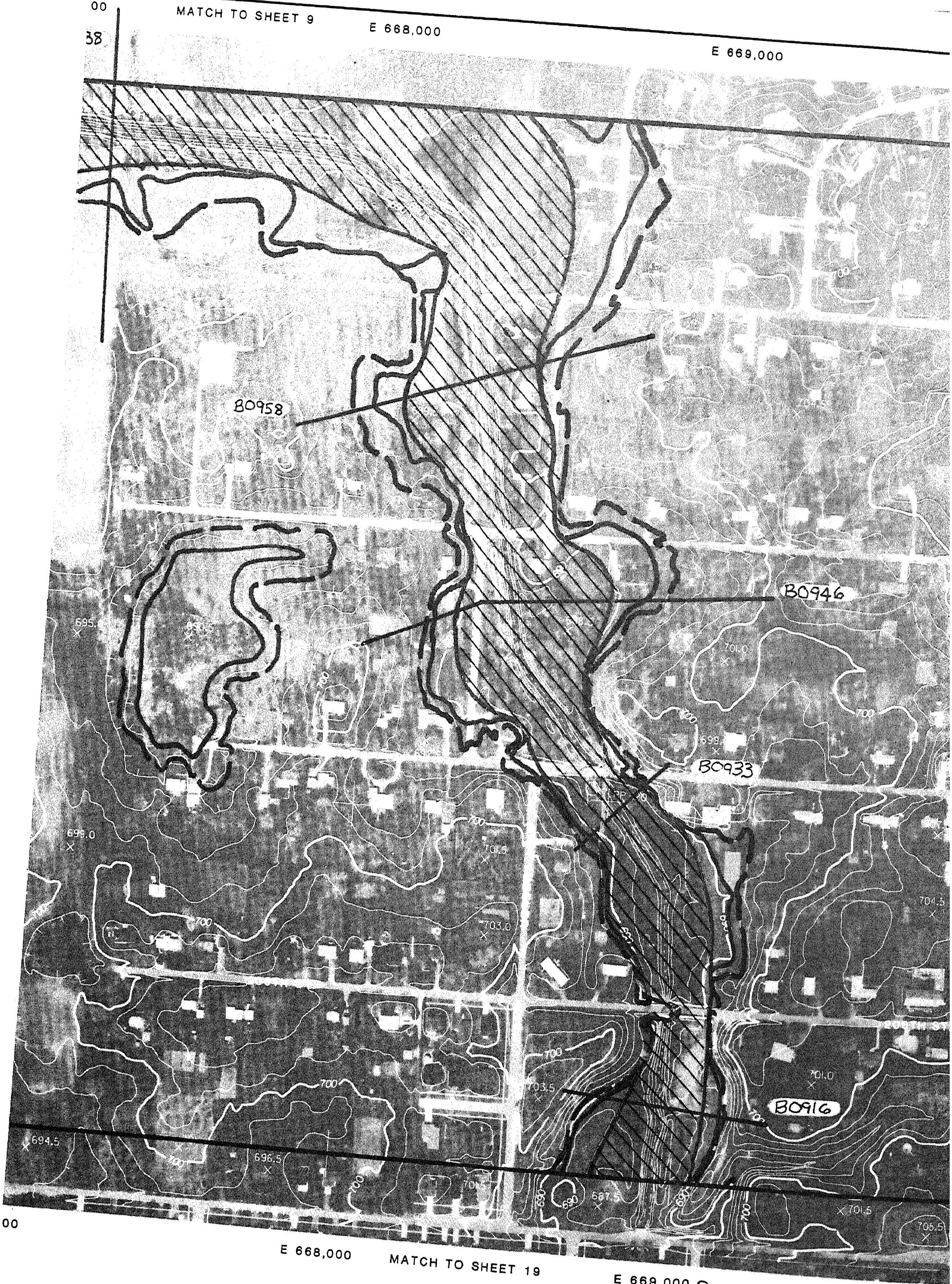
DATUM: N.G.

SCALE IN FEET

200 0 200 400 600 800

BUTTERFIELD CREEK FLOODPLAIN MAP 1986

SHEET 13 OF 31



PRESENT CONDITIONS

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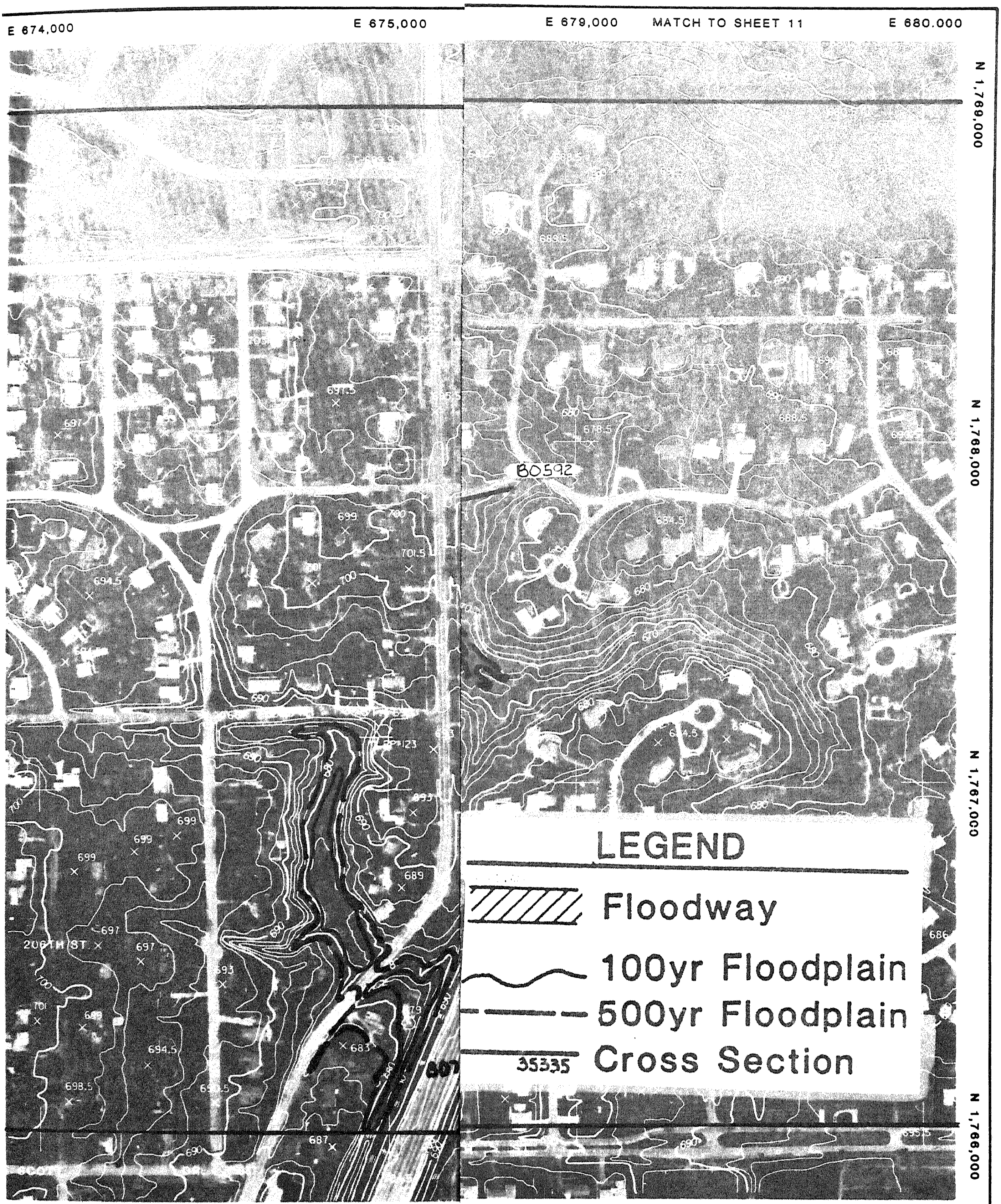
LITTLE CALUMET RIVER
BASIN
WILL AND COOK COUNTIES

BUTTERFIELD C
FLOODPLAIN M
1986



E 674,000 E 675,000 E 679,000 PRESENT CONDITIONS E 680,000

LEGEND
HORIZONTAL CONTROL STATION
HORIZONTAL CONTROL STATION (TARGETED)
BRIDGING POINT
FIELD VERTICAL POINT

ORTHOPHOTOGRAMMETRIC MAPPING

ATE OF PHOTOGRAPHY: APRIL 26,1984 CONTOU ER

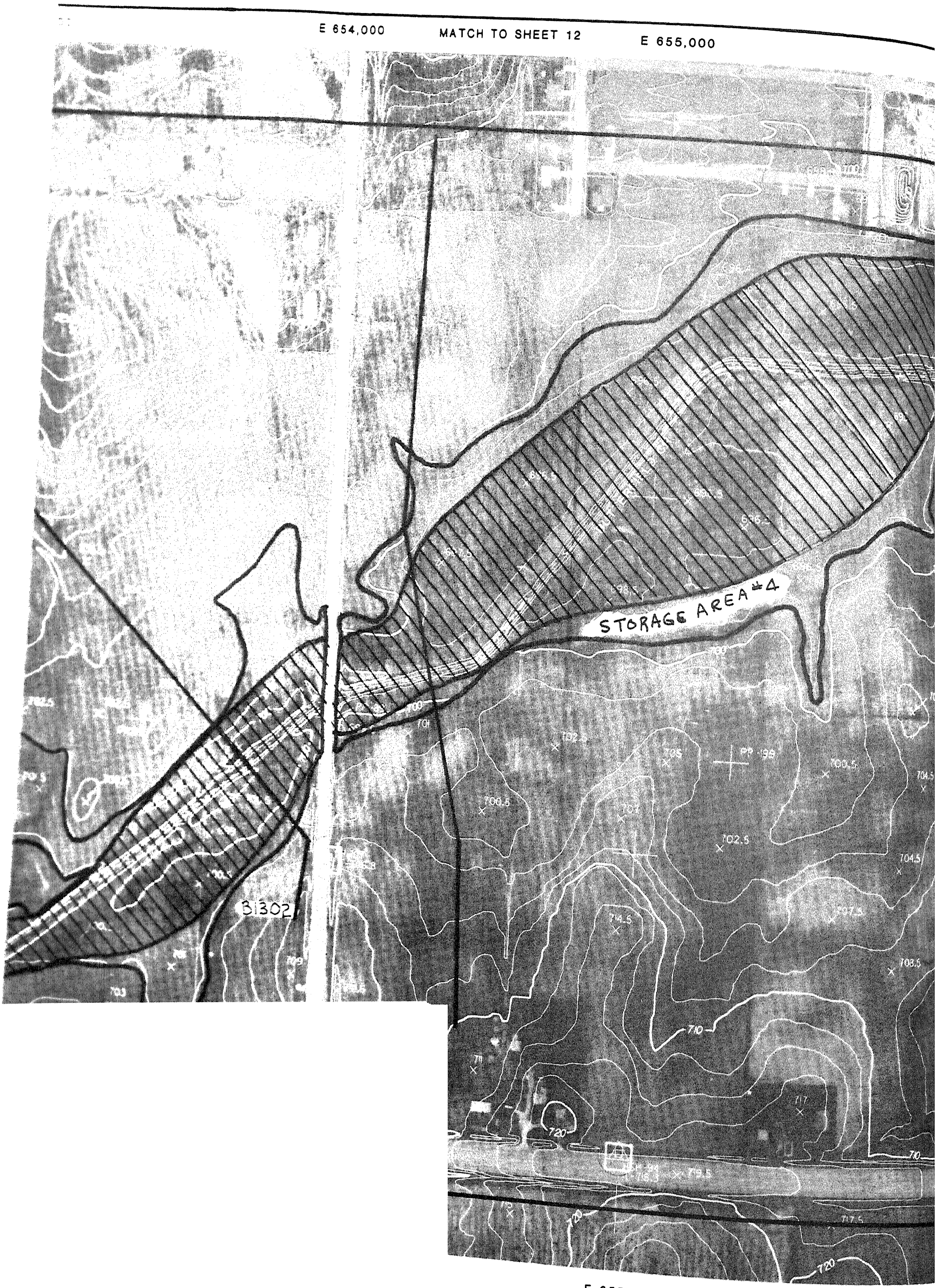
ATE OF MAPPING: OCTOBER 1984 DATUM: N.G.

SCALE IN FEET

200 0 200 400 600 800

BUTTERFIELD CREEK FLOODPLAIN MAP 1986

SHEET 15 OF 31



BUTTERFIELD CRE
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1986

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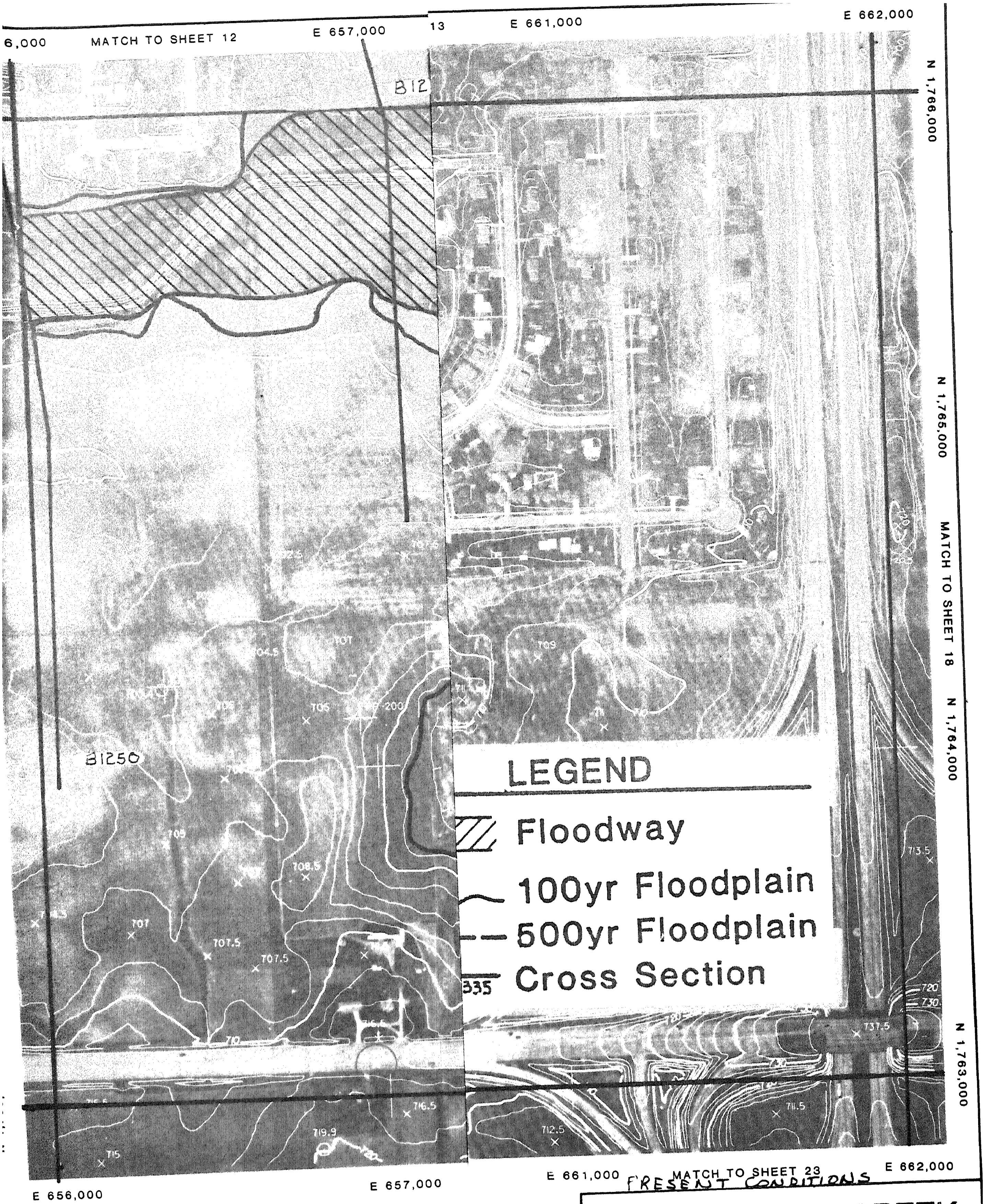
SHEET 16 OF



PRESENT CONDITIONS

BUTTERFIELD CREEK FLOODPLAIN MAP 1986

ORTHOPHOTOGRAMMETRIC MAPPING

DATE OF PHOTOGRAPHY: APRIL 26,1984

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SCALE IN FEET

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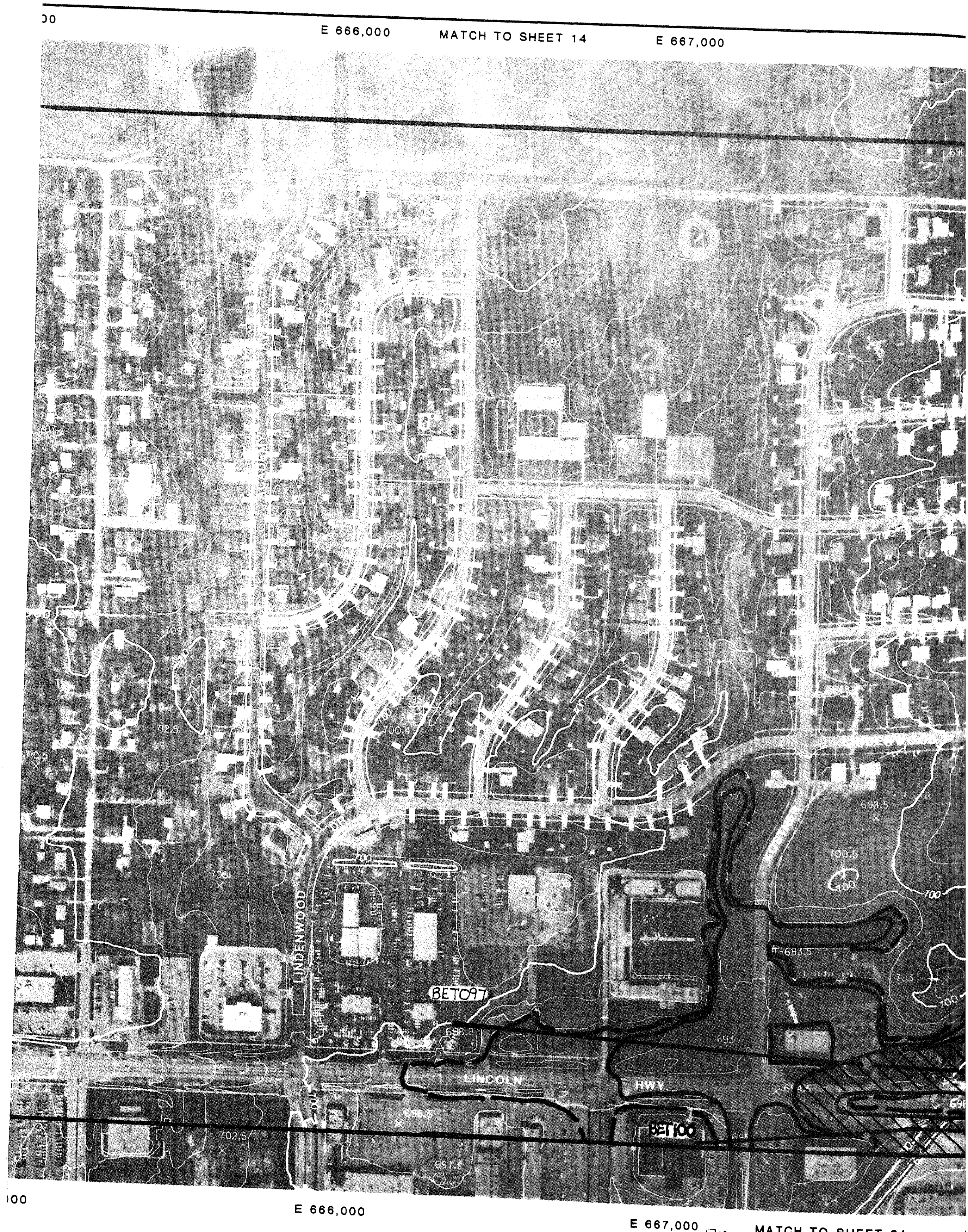

PRESENT CONDITIONS

BUTTERFIELD CR
FLOODPLAIN MA
1986

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LITTLE CALUMET RIVER
BASIN
WILL AND COOK COUNTIES

SHEET 18

LEGEND
HORIZONTAL CONTROL STATION
HORIZONTAL CONTROL STATION (TARGETED)
BRIDGING POINT
FIELD VERTICAL POINT

ORTHOPHOTOGRAMMETRIC MAPPING

DATE OF PHOTOGRAPHY: APRIL 26, 1984
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DATUM: N.G.

SCALE IN FEET
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BUTTERFIELD CREEK FLOODPLAIN MAP 1986

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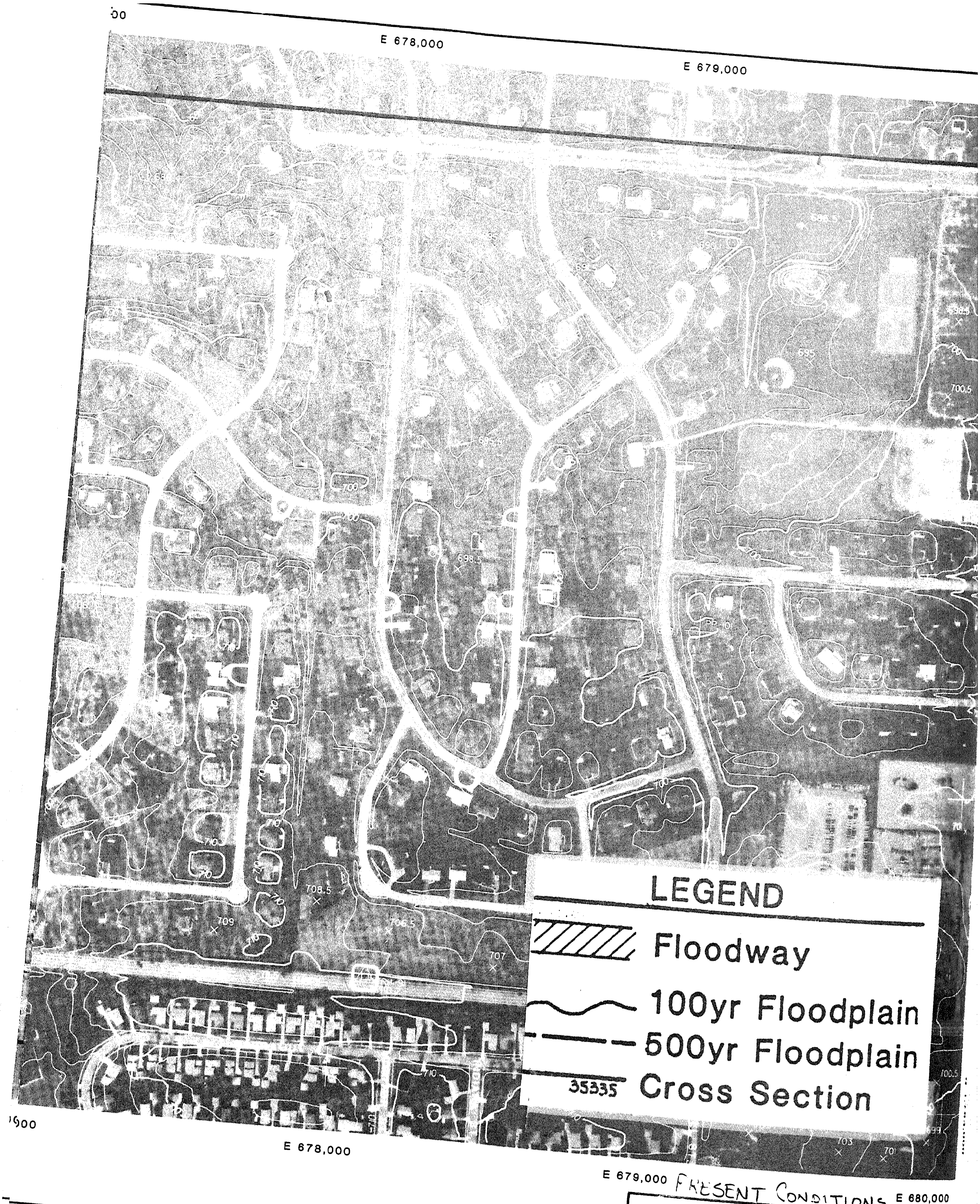
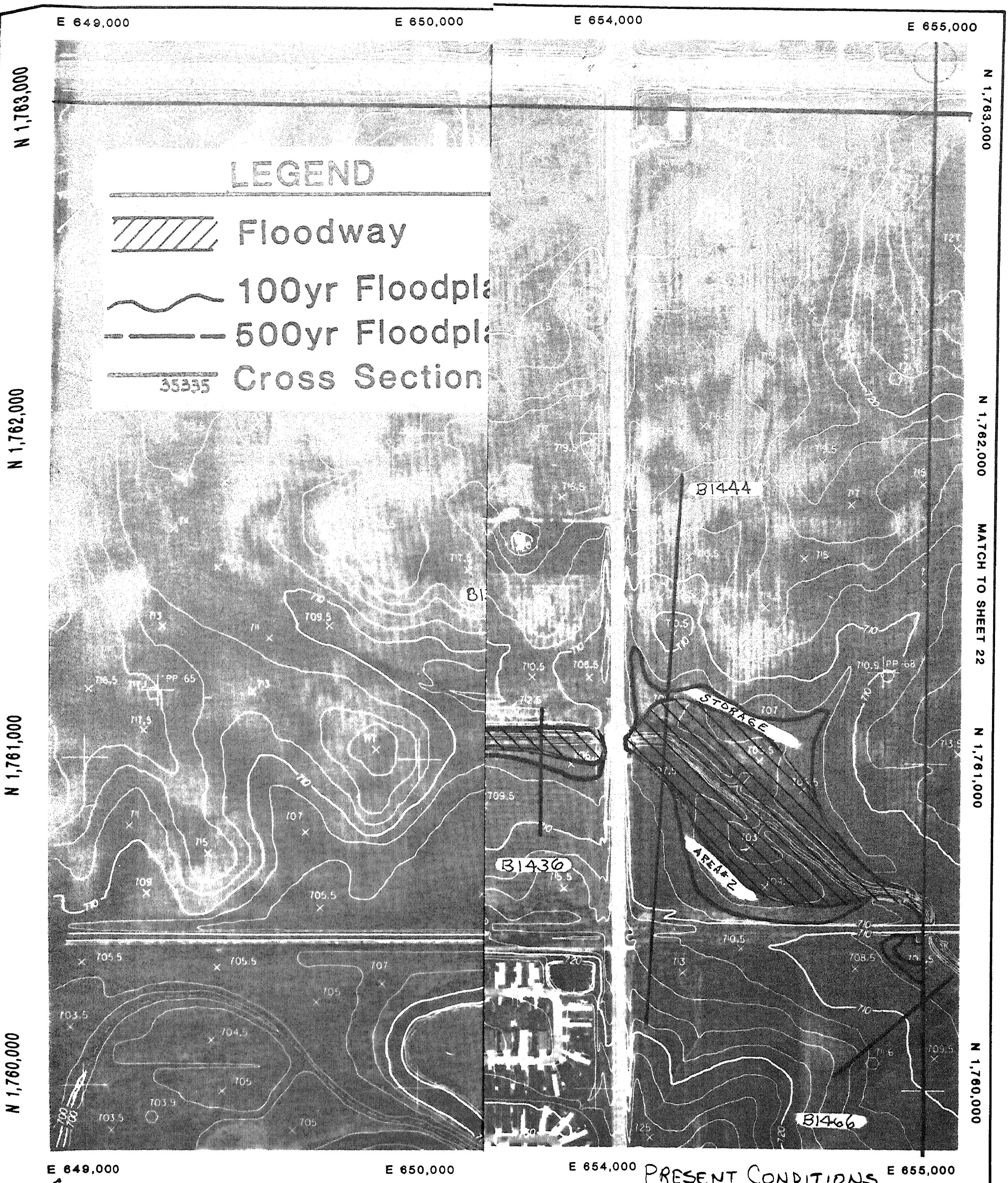


ORTATION IES ECT NO. 1321	LITTLE CALUMET RIVER BASIN WILL AND COOK COUNTIES	BUTTERFIELD CREEK FLOODPLAIN MAP 1986

SHEET 20 OF 31



LEGEND
HORIZONTAL CONTROL STATION
HORIZONTAL CONTROL STATION (TARGETED)
BRIDGING POINT
FIELD VERTICAL POINT

ORTHOPHOTOGRAMMETRIC MAPPING

DATE OF PHOTOGRAPHY: APRIL 26,1984 CONTO ER

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SCALE IN FEET

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BUTTERFIELD CREEK FLOODPLAIN MAP 1986

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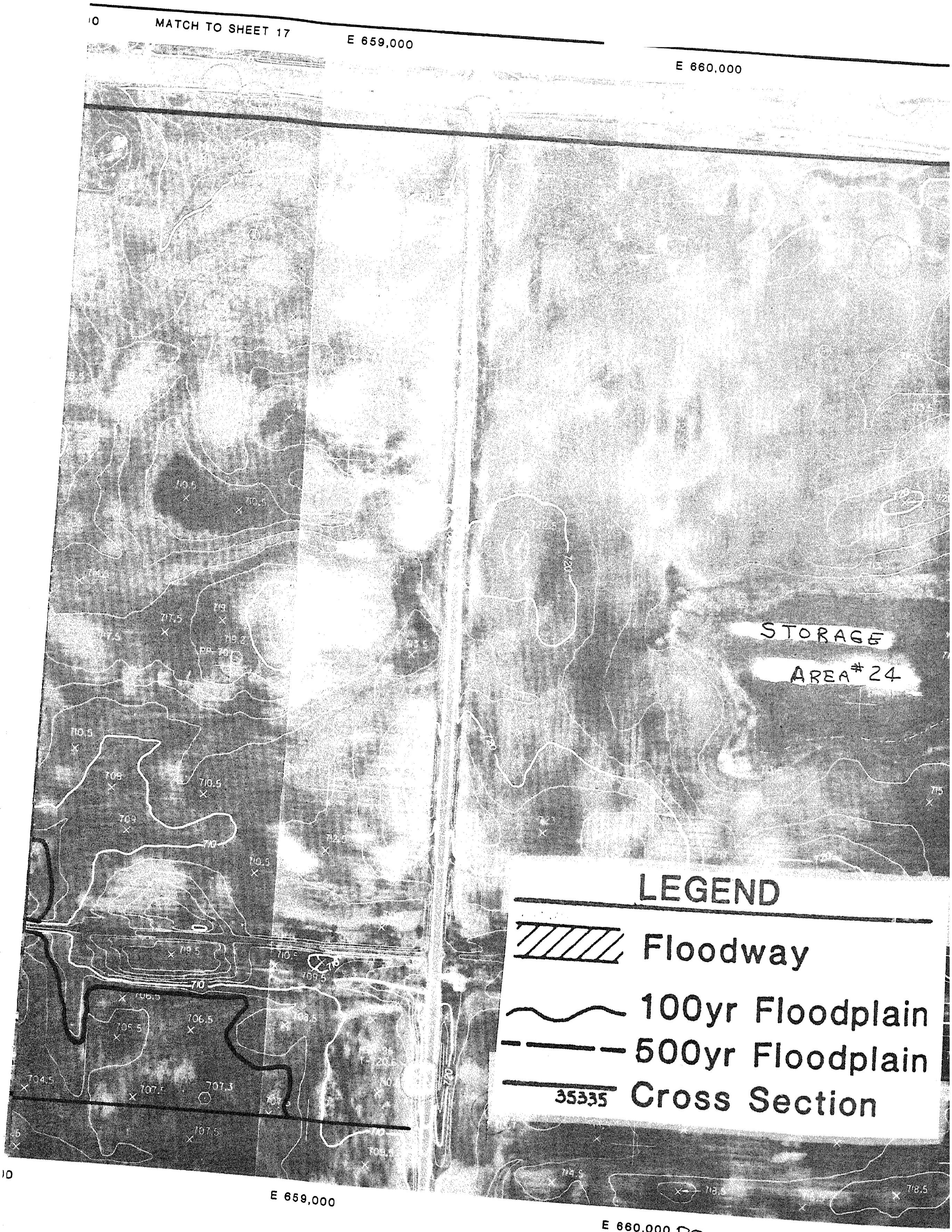

PRESENT CONDITIONS

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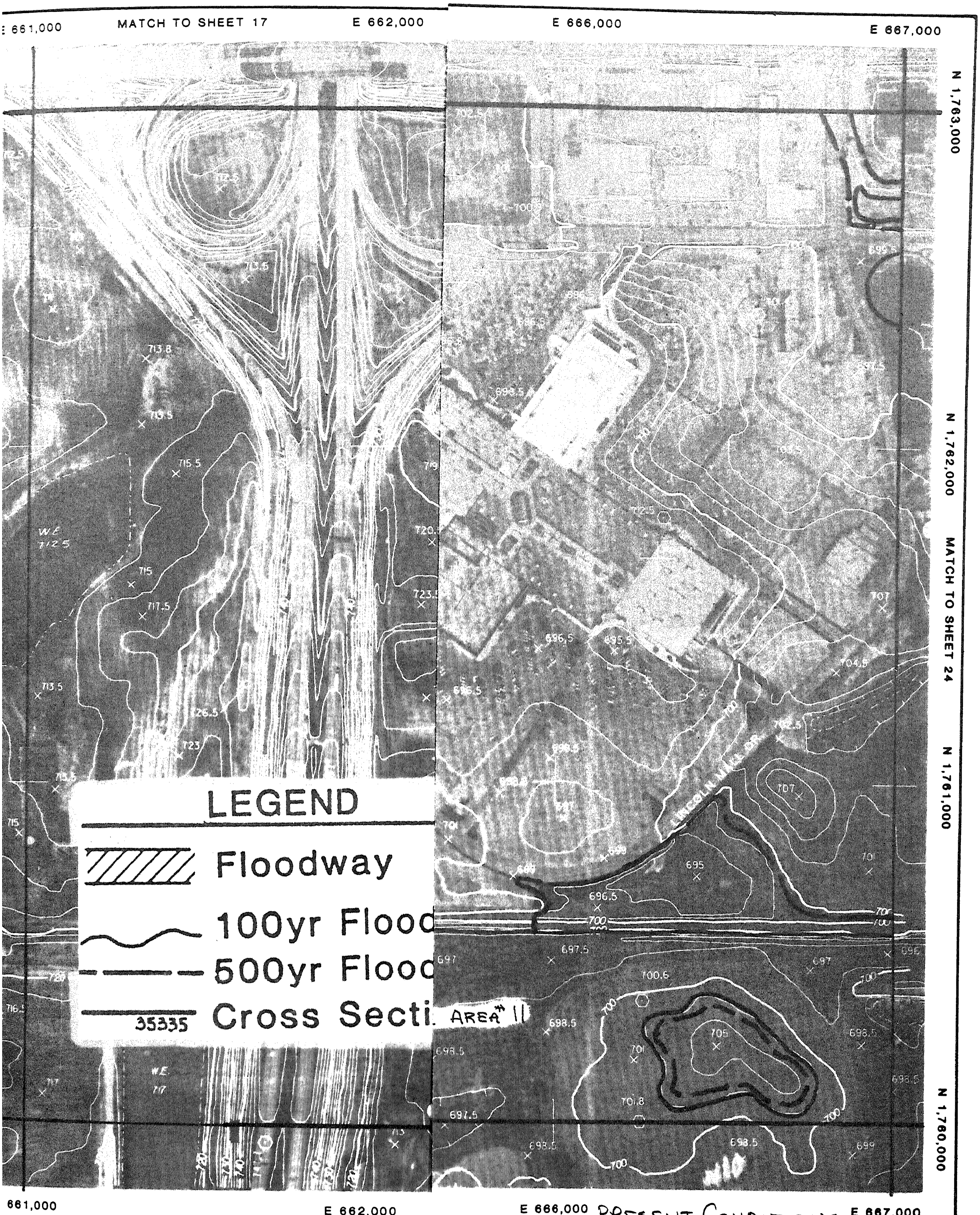
LITTLE CALUMET RIVER
BASIN
WILL AND COOK COUNTIES

BUTTERFIELD CRE
FLOODPLAIN MA
1986

SHEET 22 OF



LEGEND
HORIZONTAL CONTROL STATION
HORIZONTAL CONTROL STATION (TARGETED)
BRIDGING POINT
FIELD VERTICAL POINT

ORTHOPHOTOGRAMMETRIC MAPPING

E OF PHOTOGRAPHY: APRIL 26,1984 CONTO ER

E OF MAPPING: OCTOBER 1984 DATUM: N.G

SCALE IN FEET

200 0 200 400 600 800 S

BUTTERFIELD CREEK FLOODPLAIN MAP 1986

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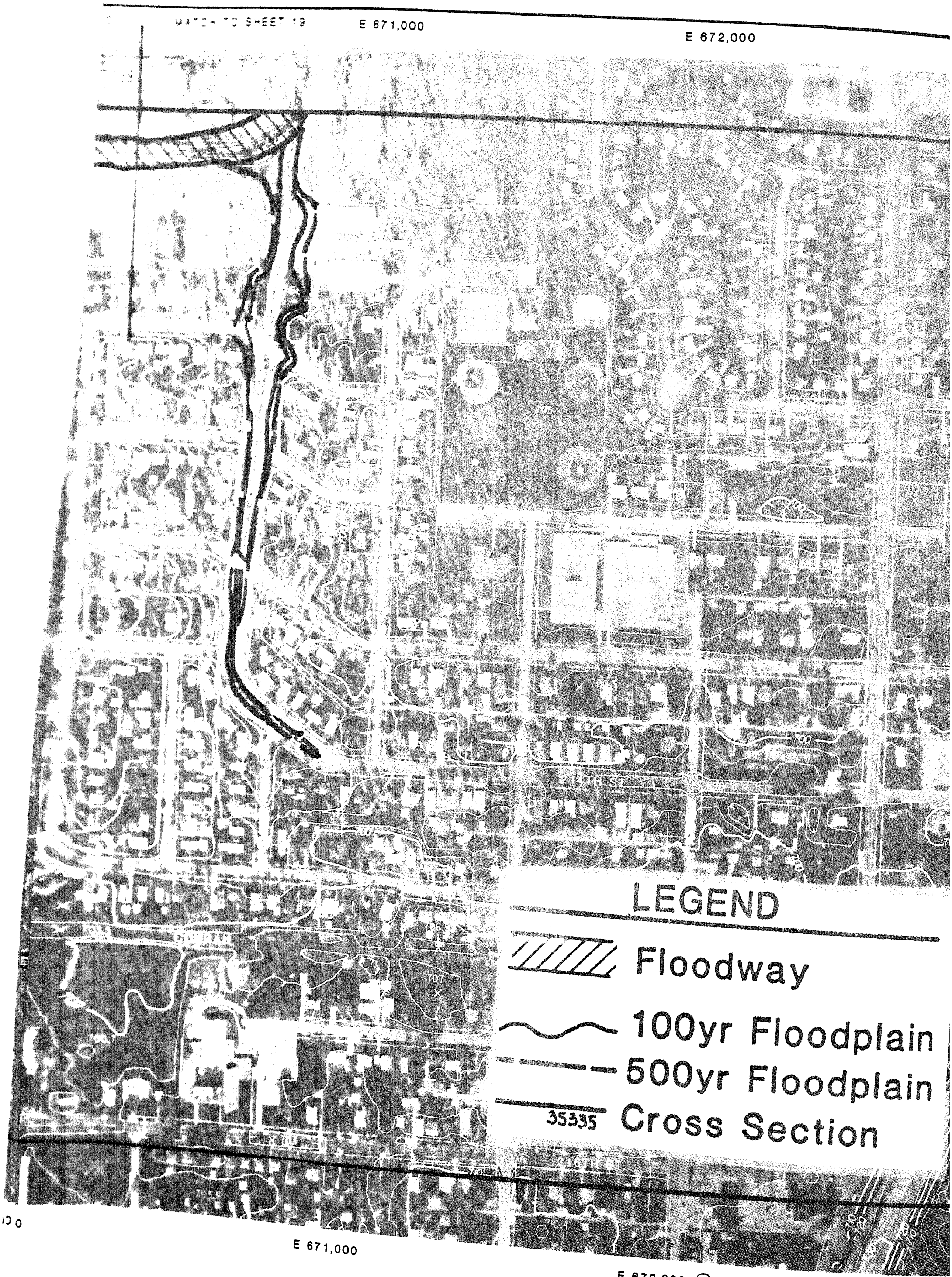

PRESENT CONDITIONS

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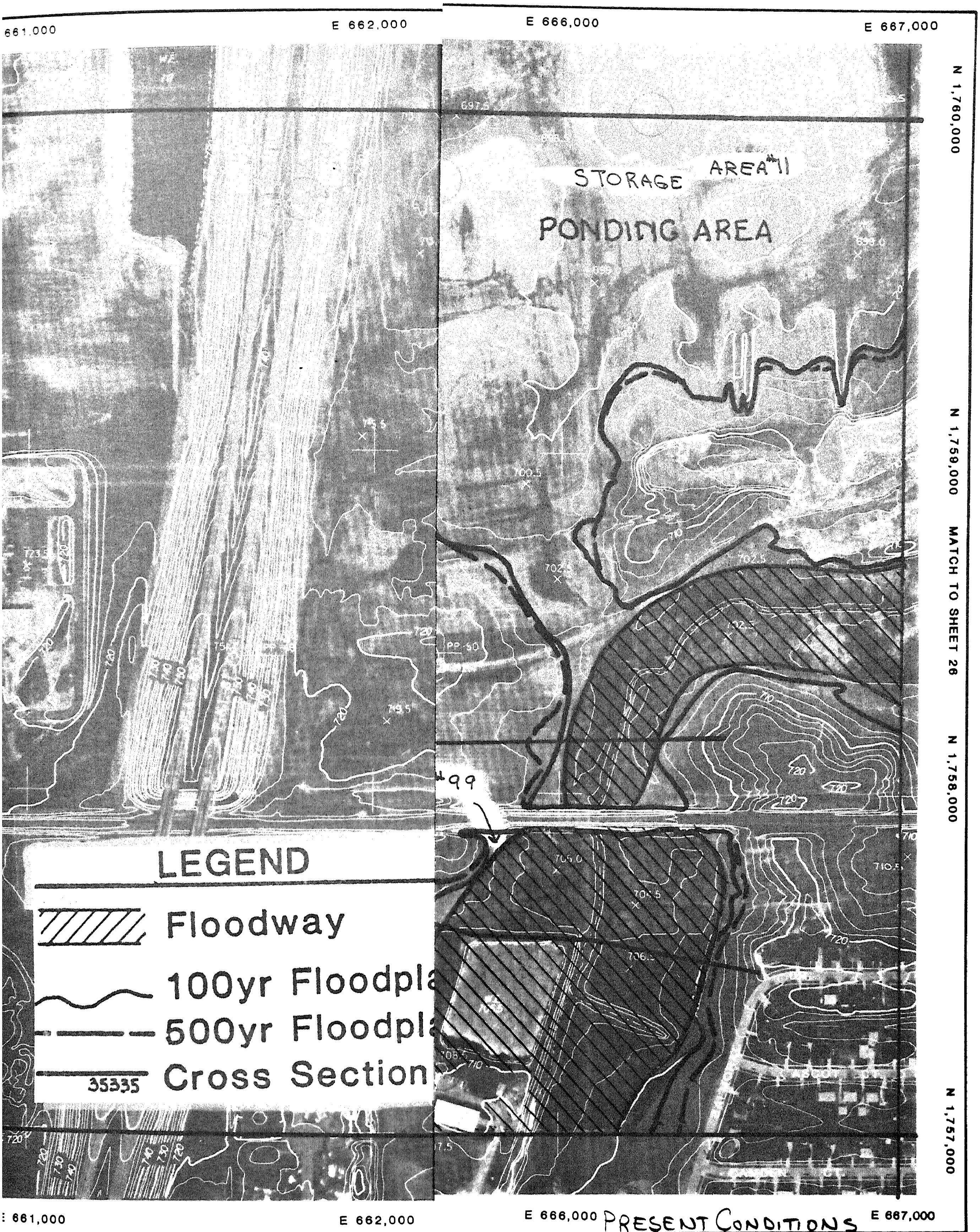
LITTLE CALUMET RIVER
BASIN
WILL AND COOK COUNTIES

BUTTERFIELD CR
FLOODPLAIN M
1986

SHEET 24



LEGEND
HORIZONTAL CONTROL STATION
HORIZONTAL CONTROL STATION (TARGETED)
BRIDGING POINT
FIELD VERTICAL POINT

ORTHOPHOTOGRAMMETRIC MAPPING

E OF PHOTOGRAPHY: APRIL 26, 1984 CONT

E OF MAPPING: OCTOBER 1984 DATUM: N.

SCALE IN FEET

200 0 200 400 600 800

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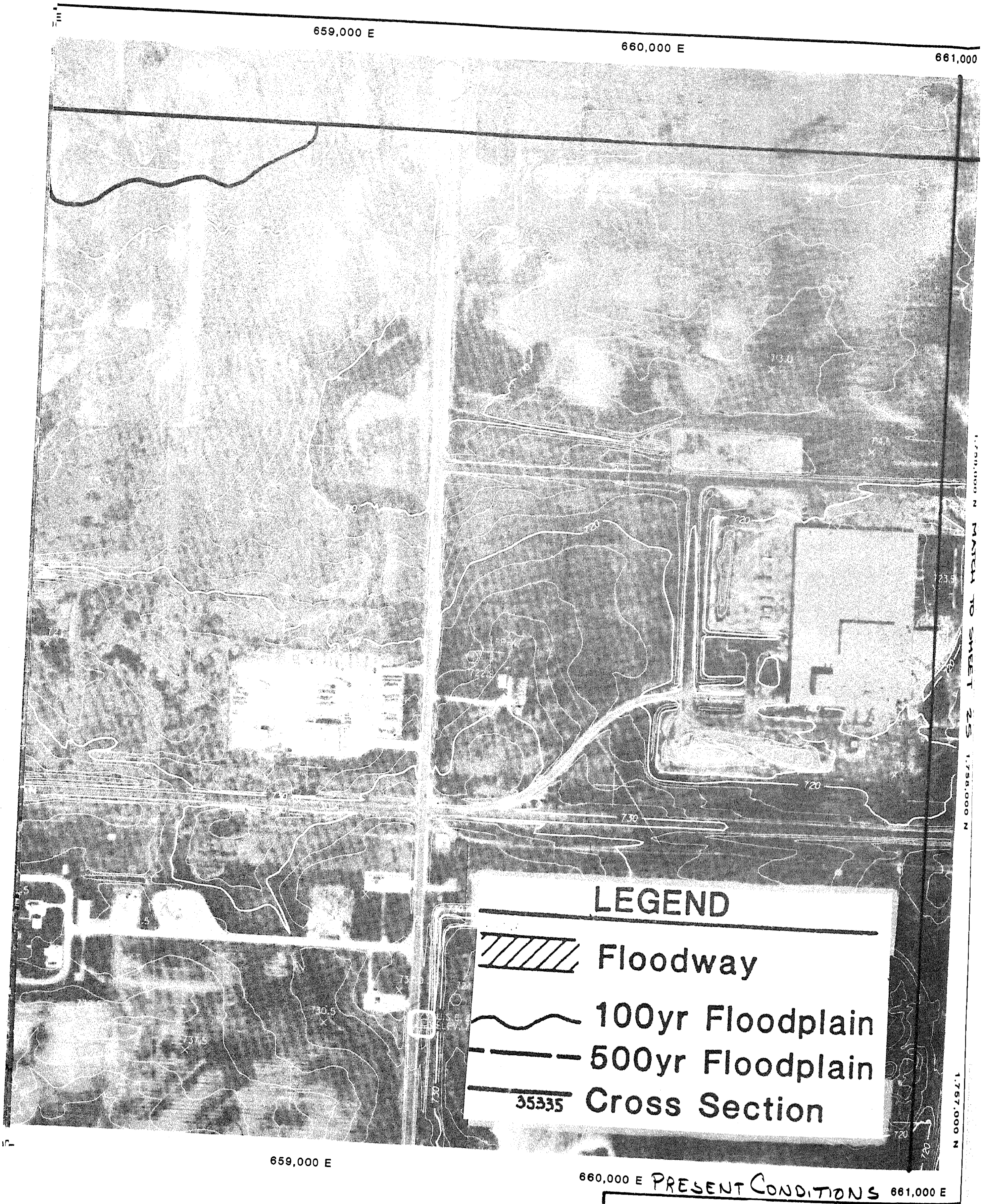
BUTTERFIELD CREEK FLOODPLAIN MAP 1986

SHEET 25 OF 31



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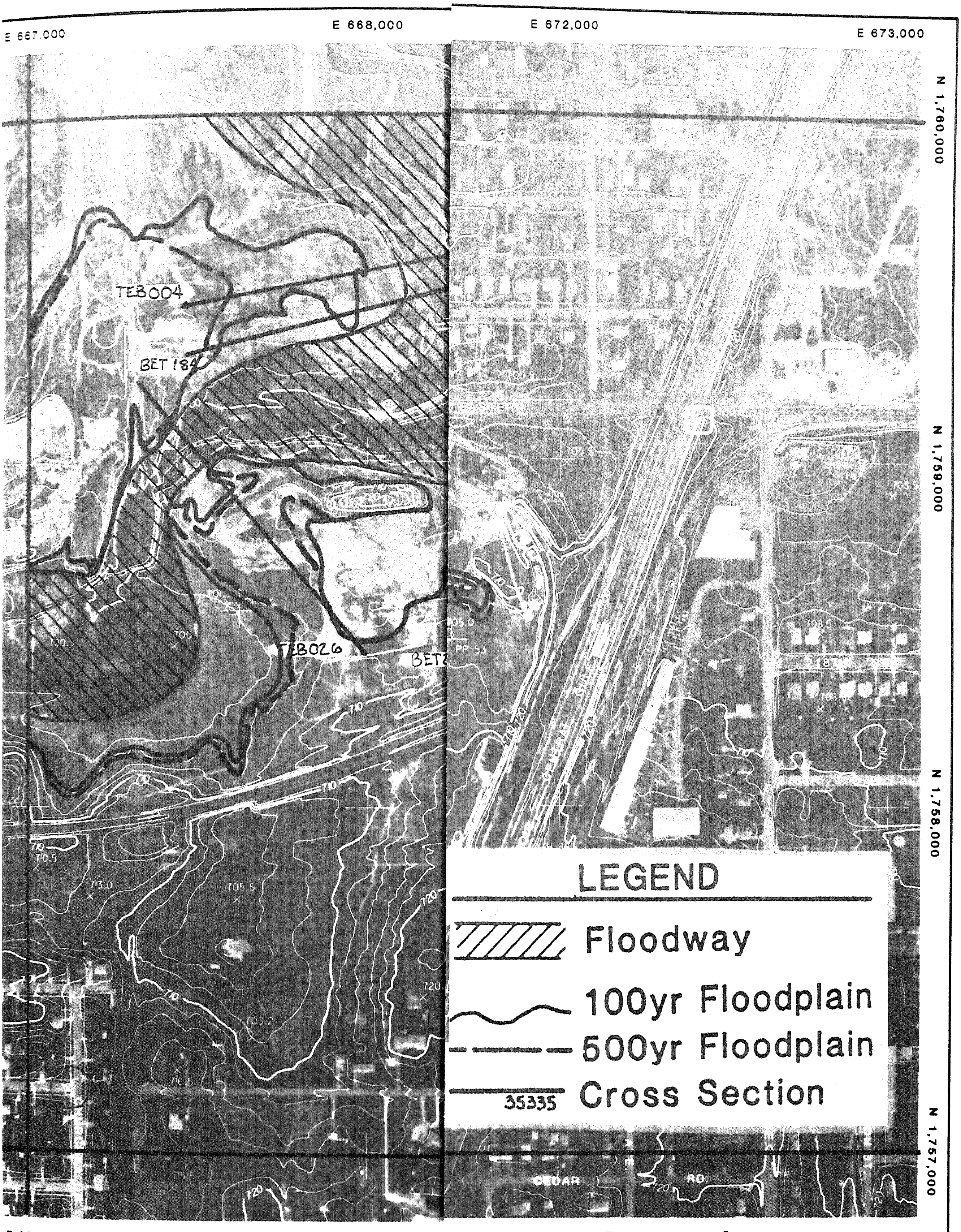
LITTLE CALUMET RIVER
BASIN
WILL AND COOK COUNTIES

BUTTERFIELD CREEK
FLOODPLAIN MAP
1986

SHEET 25A



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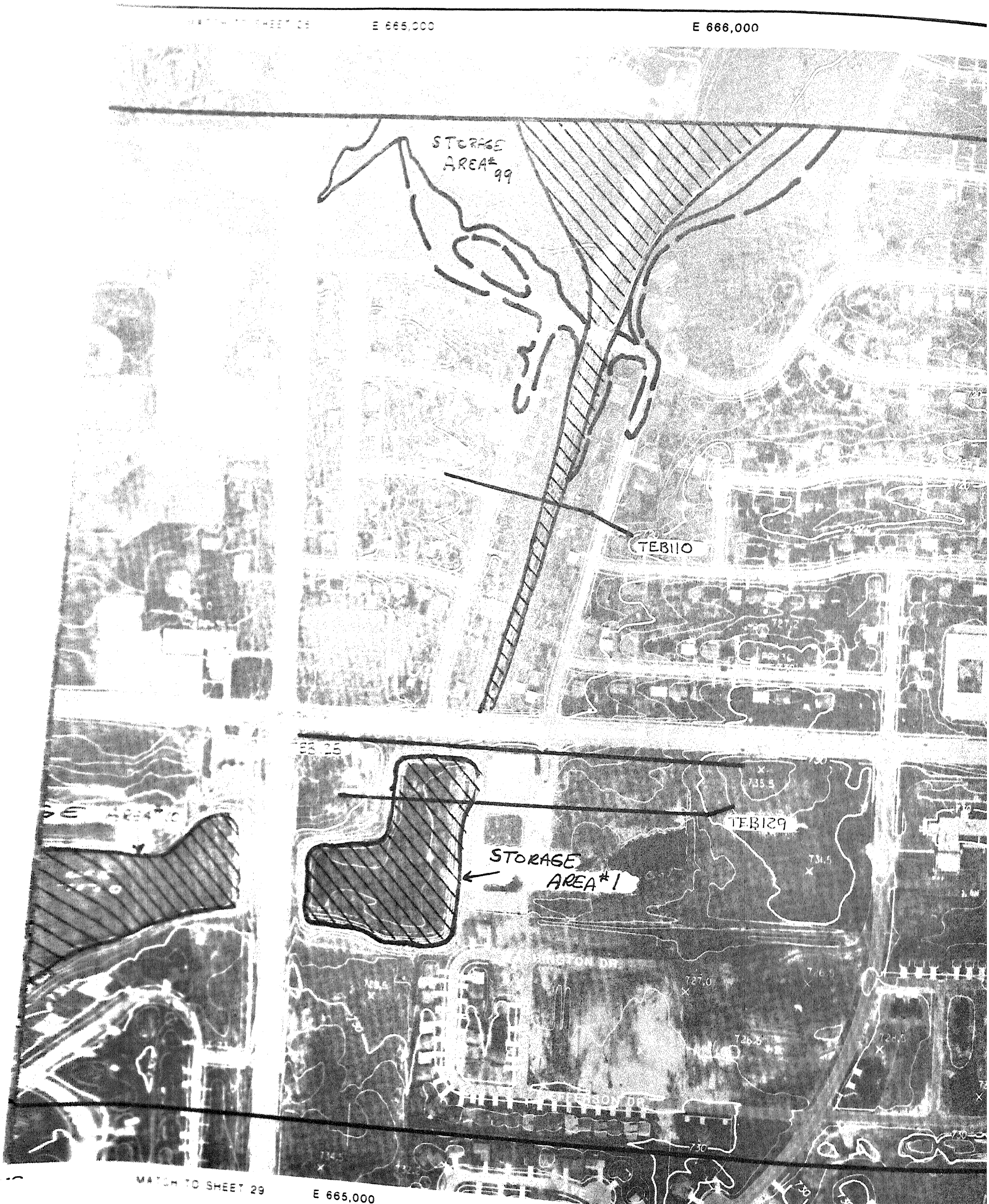
BUTTERFIELD CREEK FLOODPLAIN MAP 1986

SHEET 26 OF 31



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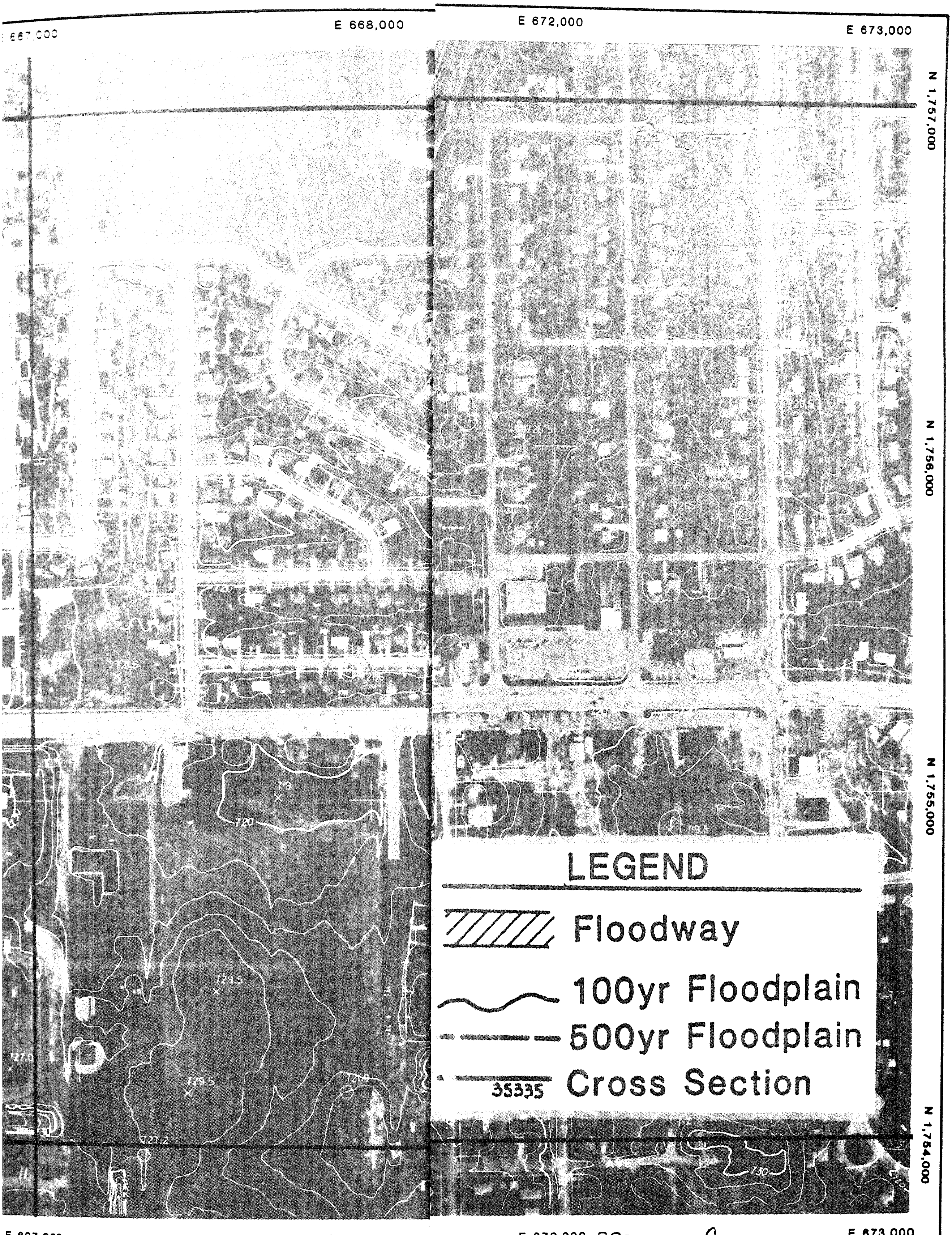
LITTLE CALUMET RIVER
BASIN
WILL AND COOK COUNTIES

BUTTERFIELD CRE
FLOODPLAIN MA
1986

SHEET 27 OF



PRESENT CONDITIONS

LEGEND
HORIZONTAL CONTROL STATION
HORIZONTAL CONTROL STATION (TARGETED)
BRIDGING POINT
FIELD VERTICAL POINT

ORTHOPHOTOGRAMMETRIC MAPPING

TE OF PHOTOGRAPHY: APRIL 26,1984 CONT ER

TE OF MAPPING: OCTOBER 1984 DATUM: N.

SCALE IN FEET

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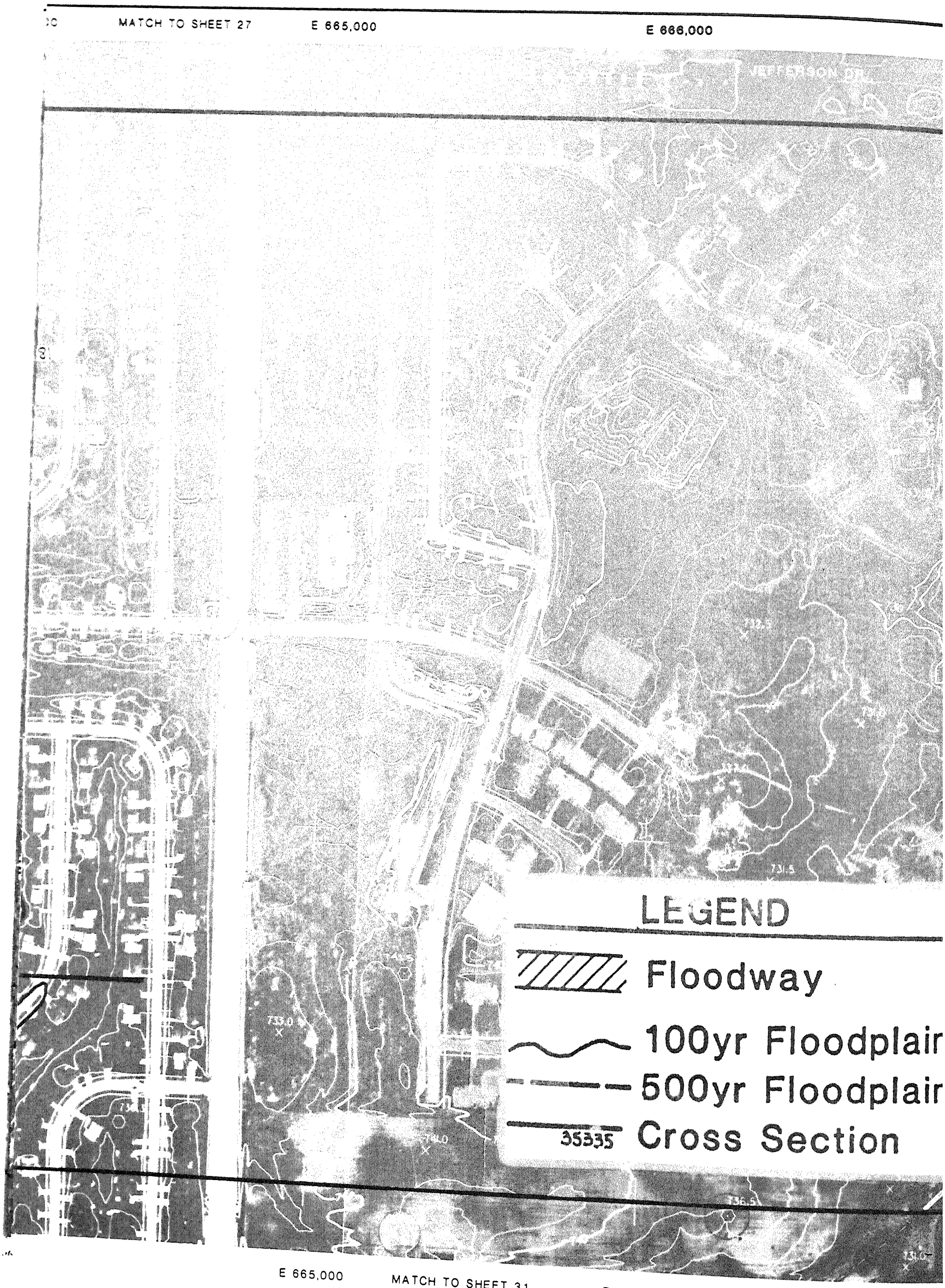
BUTTERFIELD CREEK FLOODPLAIN MAP 1986

SHEET 28 OF 31



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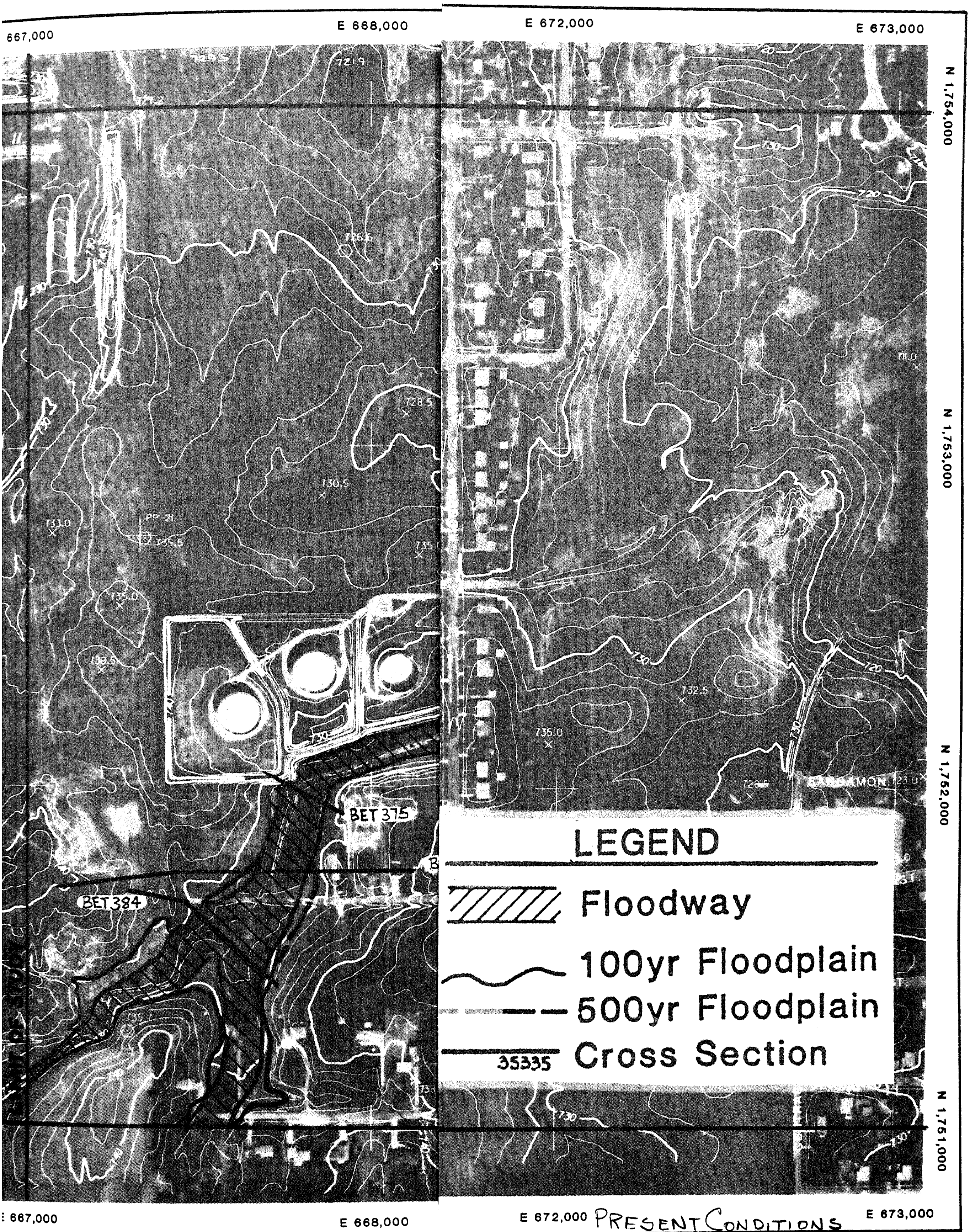
LITTLE CALUMET RIVER
BASIN
WILL AND COOK COUNTIES

BUTTERFIELD CF
FLOODPLAIN M
1986



LEGEND
HORIZONTAL CONTROL STATION
HORIZONTAL CONTROL STATION (TARGETED)
BRIDGING POINT
FIELD VERTICAL POINT

ORTHOPHOTOGRAMMETRIC MAPPING

TE OF PHOTOGRAPHY: APRIL 26,1984 CONTO

TE OF MAPPING: OCTOBER 1984 DATUM: N.G

SCALE IN FEET

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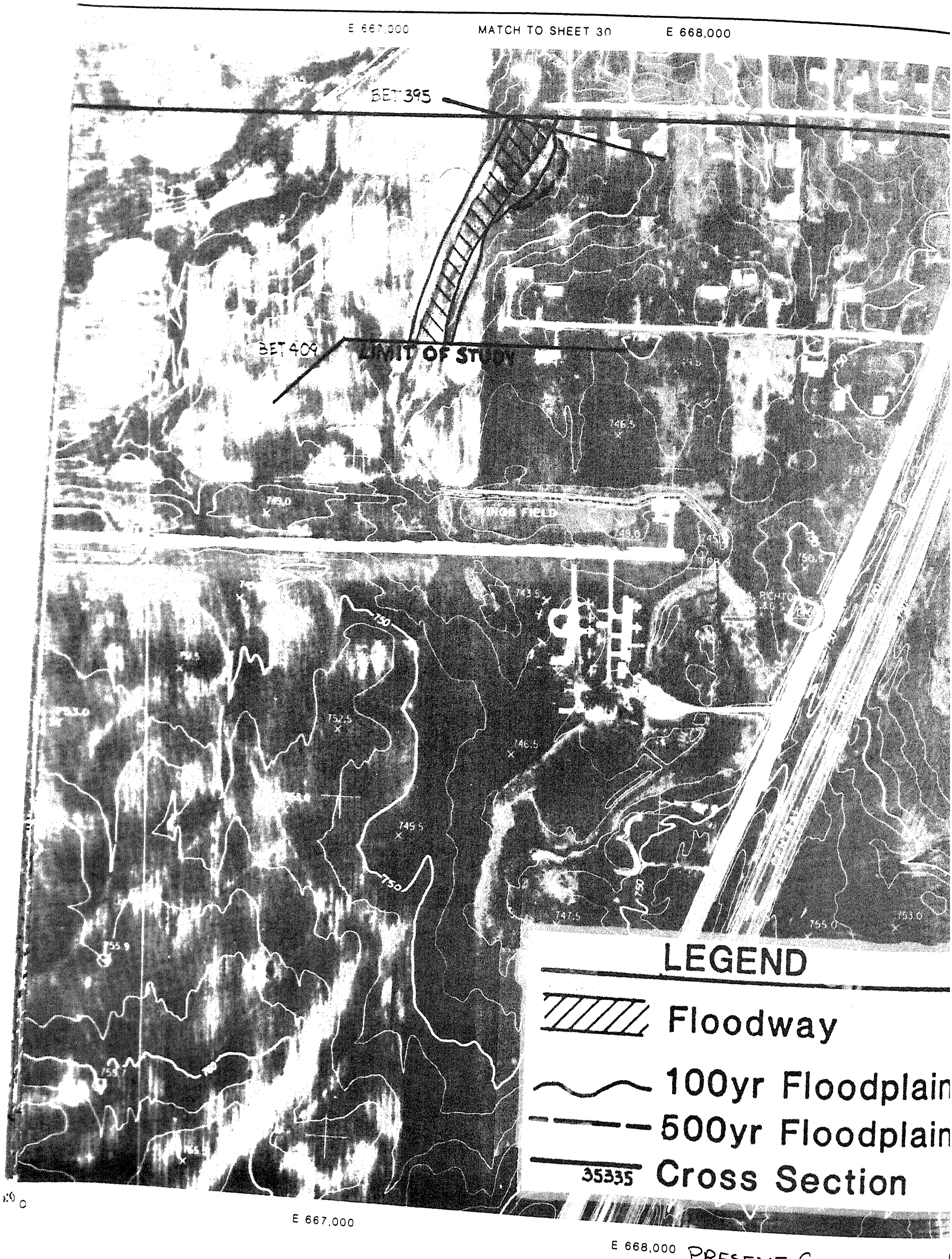
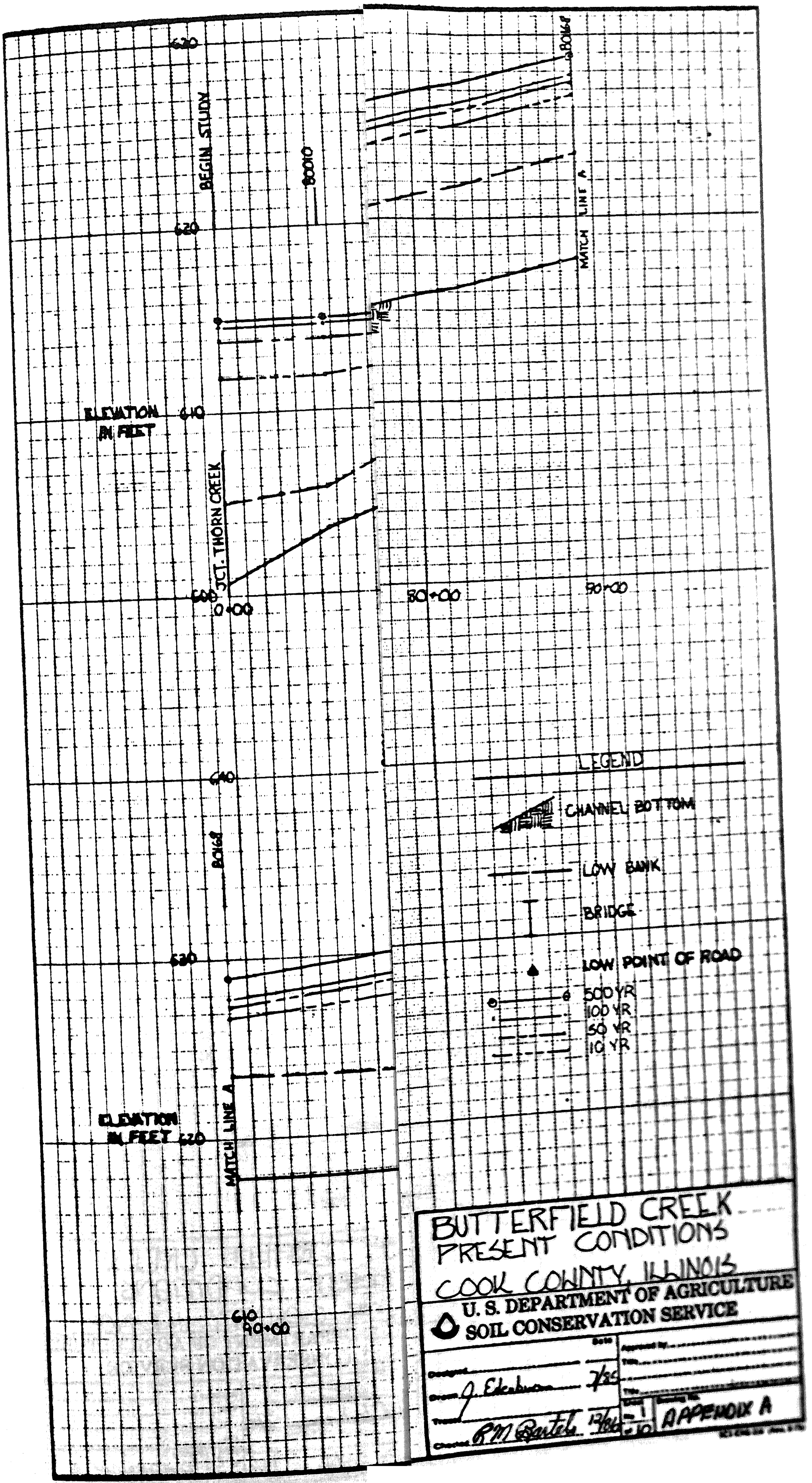
BUTTERFIELD CREEK FLOODPLAIN MAP 1986

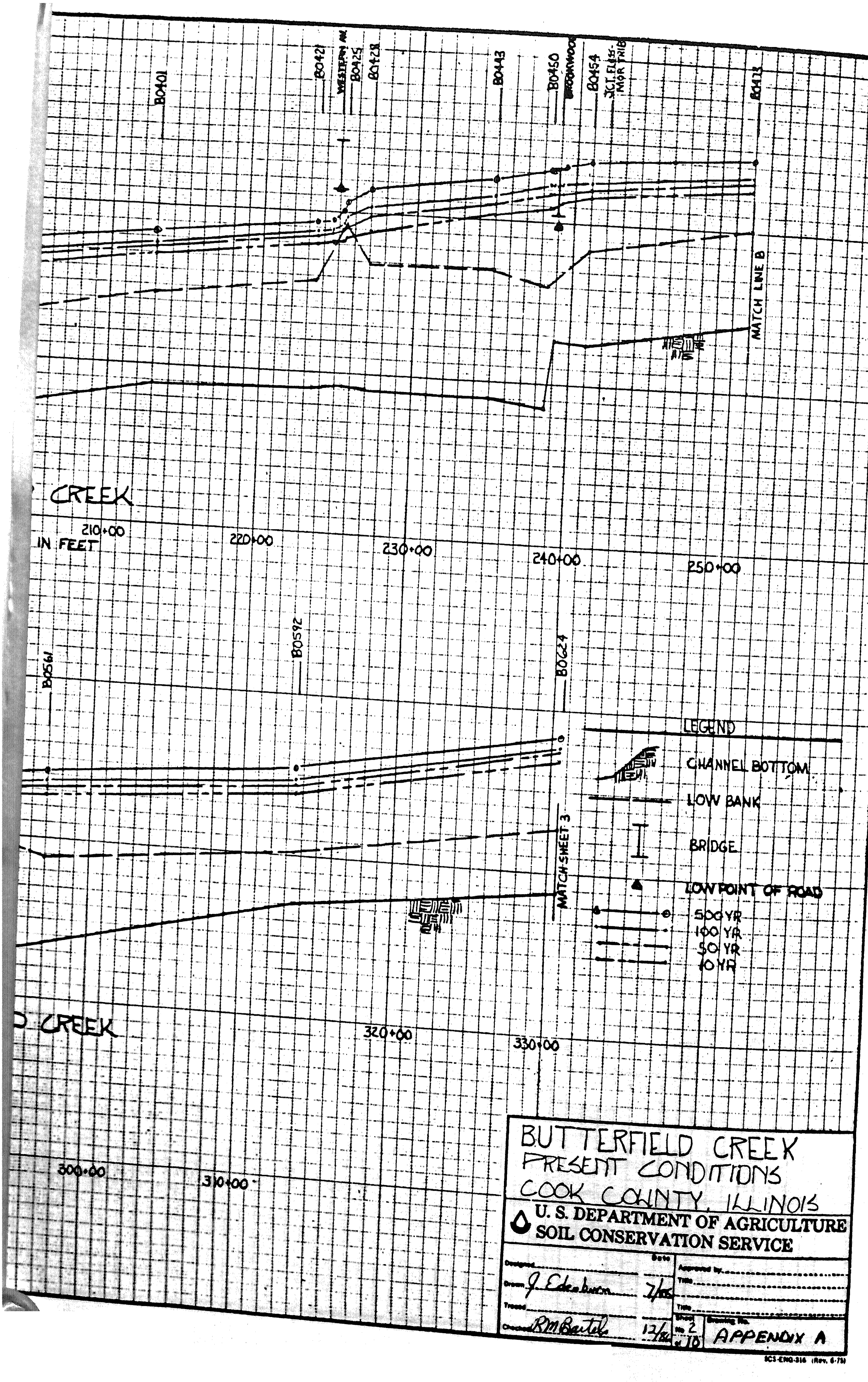
SHEET 30 OF 31

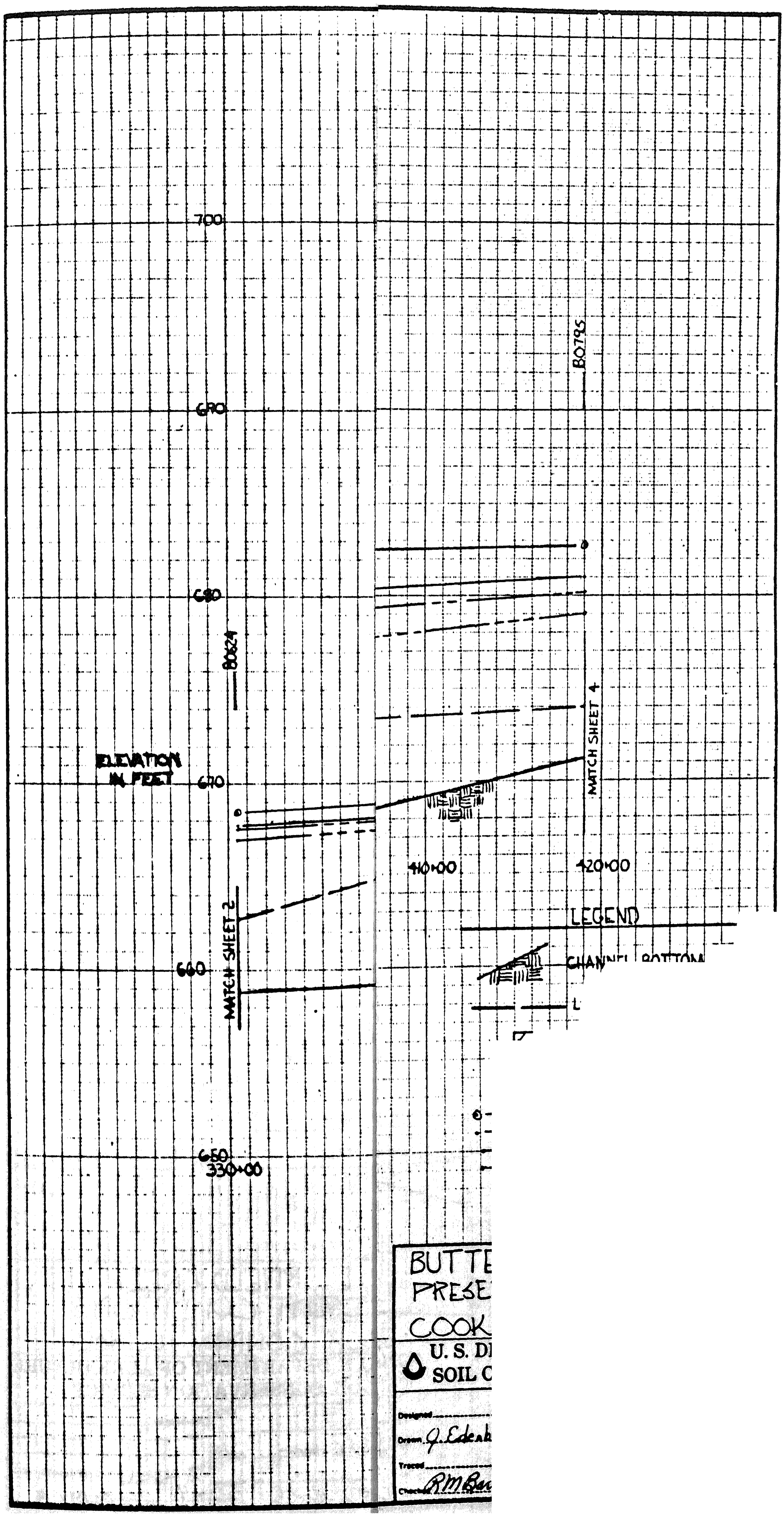


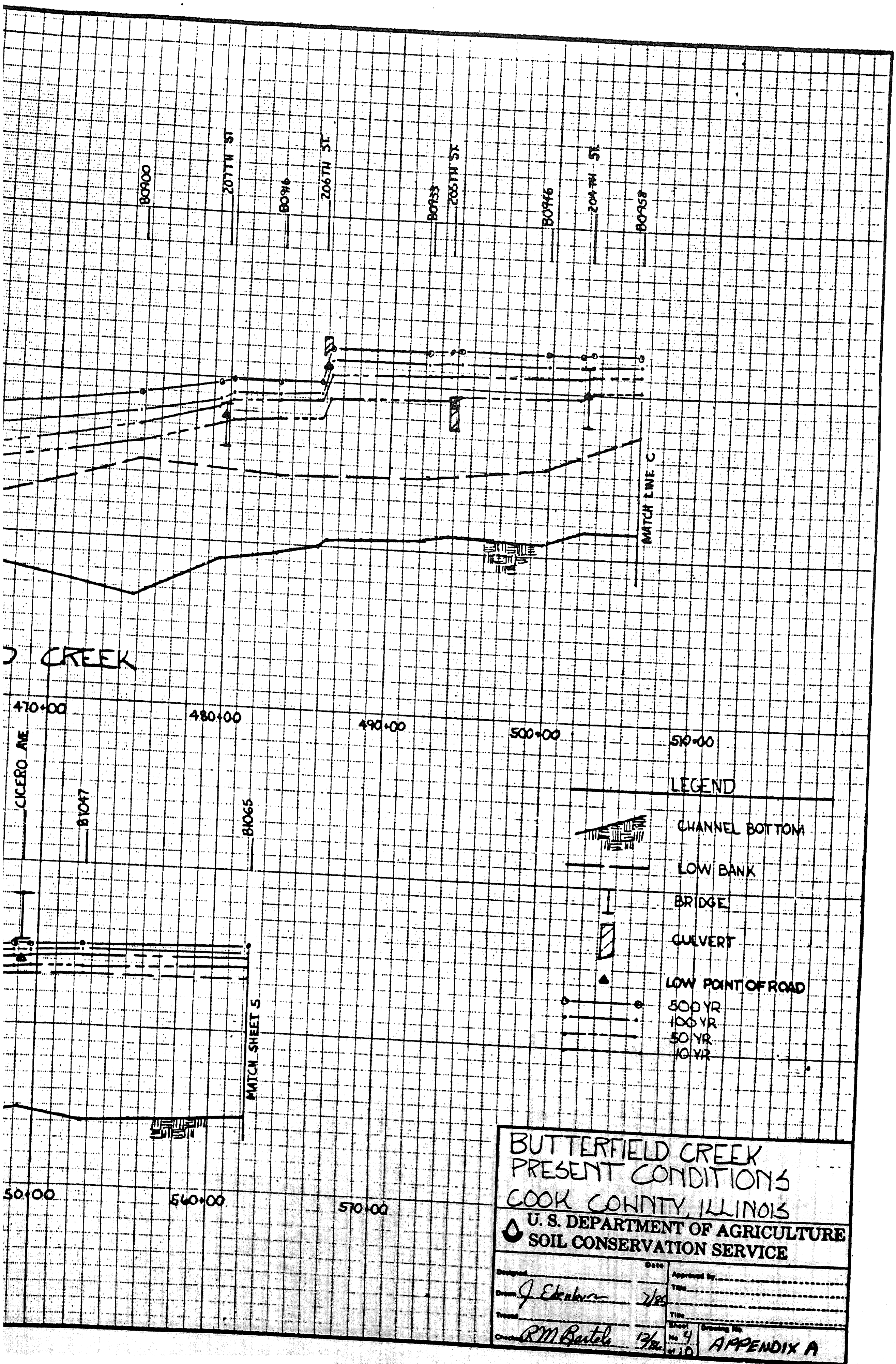
PRESENT CONDITIONS

ON	LITTLE CALUMET RIVER BASIN WILL AND COOK COUNTIES	BUTTERFIELD CR FLOODPLAIN MA 1986
NO.		SHEET 31


BEGIN STUDY
B0010
JCT. THORN CREEK
ELEVATION IN FEET
0+00
80+00
90+00
B0168
MATCH LINE A
LEGEND
CHANNEL BOTTOM
LOW BANK
BRIDGE
LOW POINT OF ROAD
500 YR
100 YR
50 YR
10 YR
BUTTERFIELD CREEK
PRESENT CONDITIONS
COOK COUNTY, ILLINOIS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
APPENDIX A


B0401
B0421
WESTERN AV.
B0425
B0428
B0443
B0450
BROOKWOOD
B0454
JCT. FLOSS-MOR TRIB
B0473
MATCH LINE B
CREEK
IN FEET
210+00
220+00
230+00
240+00
250+00
B0561
B0592
B0624
MATCH SHEET 3
LEGEND
CHANNEL BOTTOM
LOW BANK
BRIDGE
LOW POINT OF ROAD
500 YR
100 YR
50 YR
10 YR
CREEK
320+00
330+00
300+00
310+00
BUTTERFIELD CREEK
PRESENT CONDITIONS
COOK COUNTY, ILLINOIS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed
Date
Drawn J. Edenburn 7/86
Traced
Checked RM Bartel 12/86
Approved by
Title
Sheet No. 2 of 10
Drawing No. APPENDIX A
SCS-ENG-316 (Rev. 6-75)


700
690
680
670
660
650
330+00
ELEVATION IN FEET
B0824
B0795
MATCH SHEET 2
MATCH SHEET 4
410+00
420+00
LEGEND
Designed
Drawn
Traced
Checked

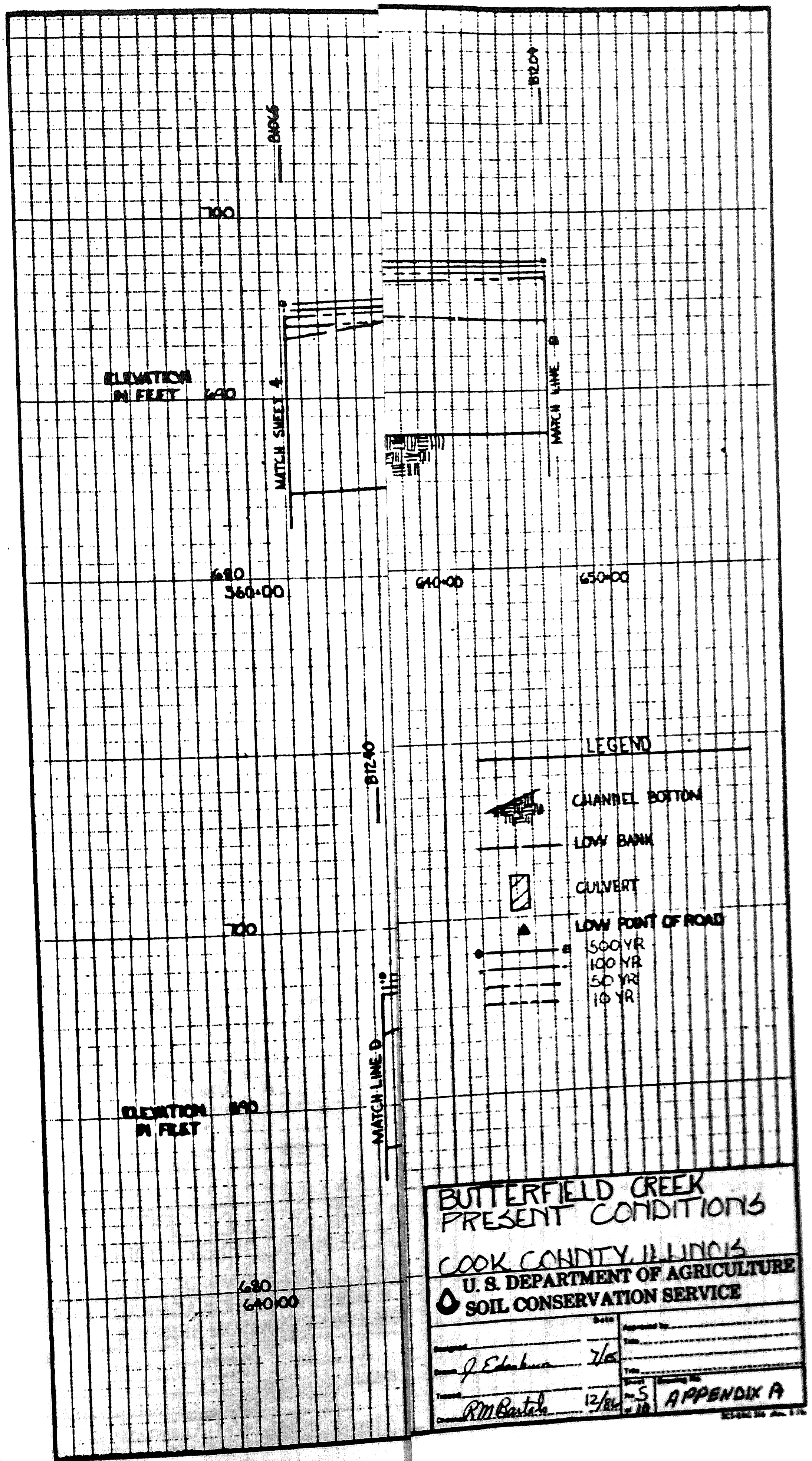


BUTTERFIELD CREEK
PRESENT CONDITIONS
COOK COUNTY, ILLINOIS

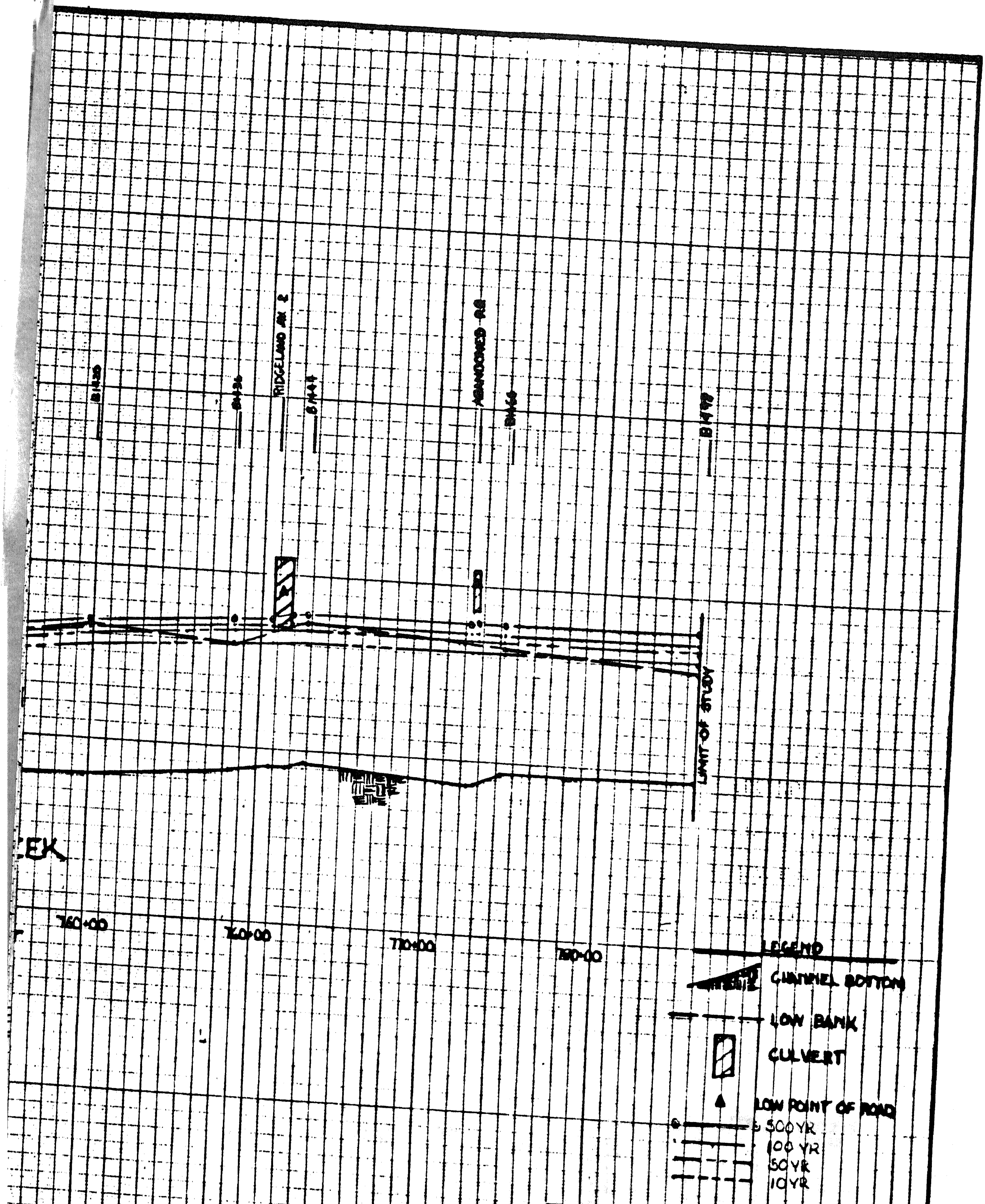
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by	
Drawn J. Ebenhoe	7/85	Title	
Traced		Title	
Checked RM Bartels	12/86	Sheet No. 4 of 10	Drawing No. APPENDIX A

SCS-ENG-310 (Rev. 5-72)



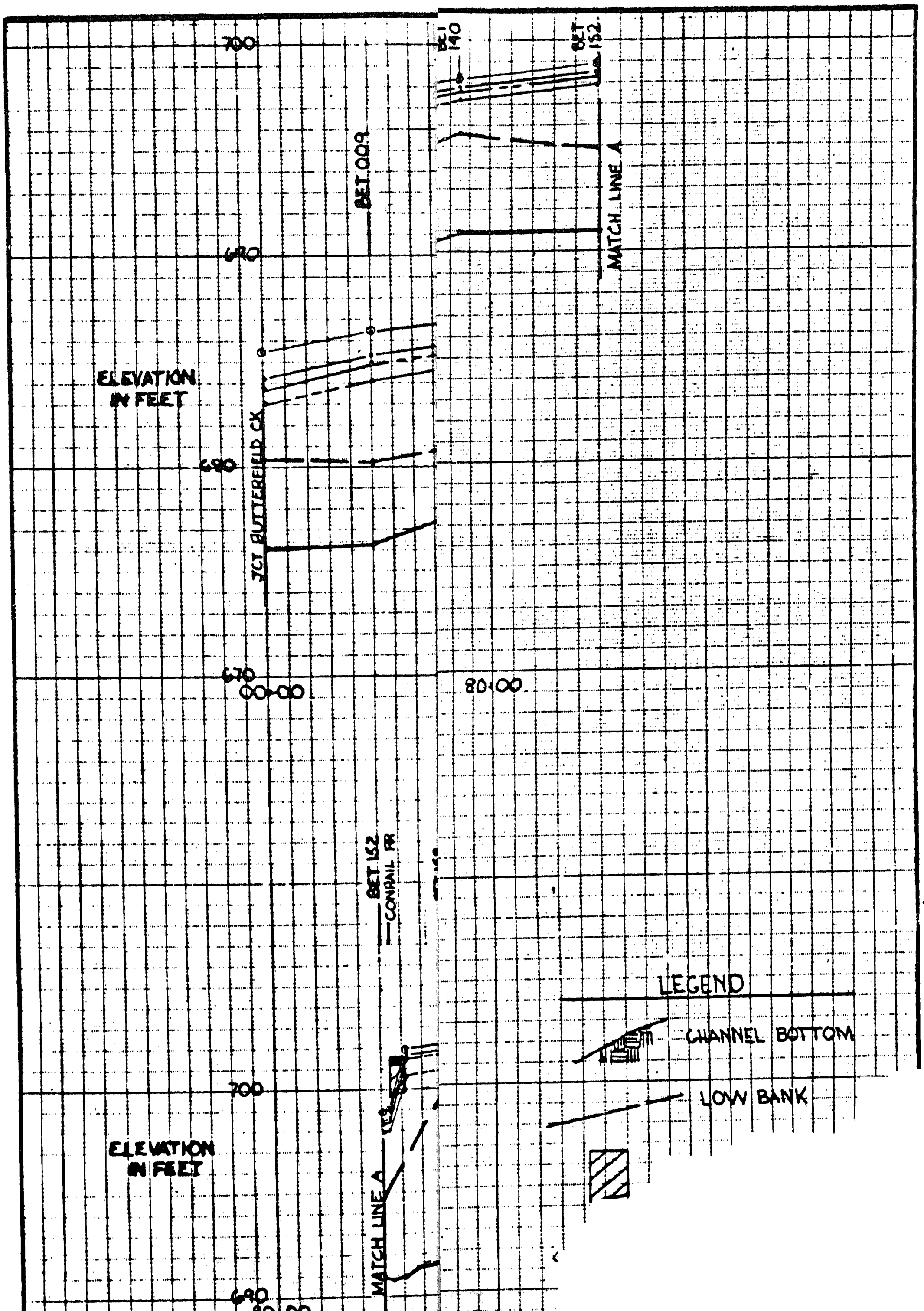
700
ELEVATION IN FEET 690
MATCH SHEET 4
MATCH LINE D
680
560+00
640+00
650+00
B1204
B1240
LEGEND
CHANNEL BOTTOM
LOW BANK
CULVERT
LOW POINT OF ROAD
500 YR
100 YR
50 YR
10 YR
700
MATCH LINE D
ELEVATION IN FEET 690
680
640+00
BUTTERFIELD CREEK
PRESENT CONDITIONS
COOK COUNTY, ILLINOIS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Date
Approved by
Title
Designed
Drawn J. Edenburn 7/85
Traced
Checked RM Bartels 12/86
Sheet No. 5 of 10
Drawing No. APPENDIX A



BUTTERFIELD CREEK
PRESENT CONDITIONS
COOK COUNTY, ILLINOIS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed		Date	Approved by
Drawn J. Edelburn	7/85		Title
Traced			Title
Checked RM Batch	12/86	Sheet No. 6 of 10	Drawing No. APPENDIX A

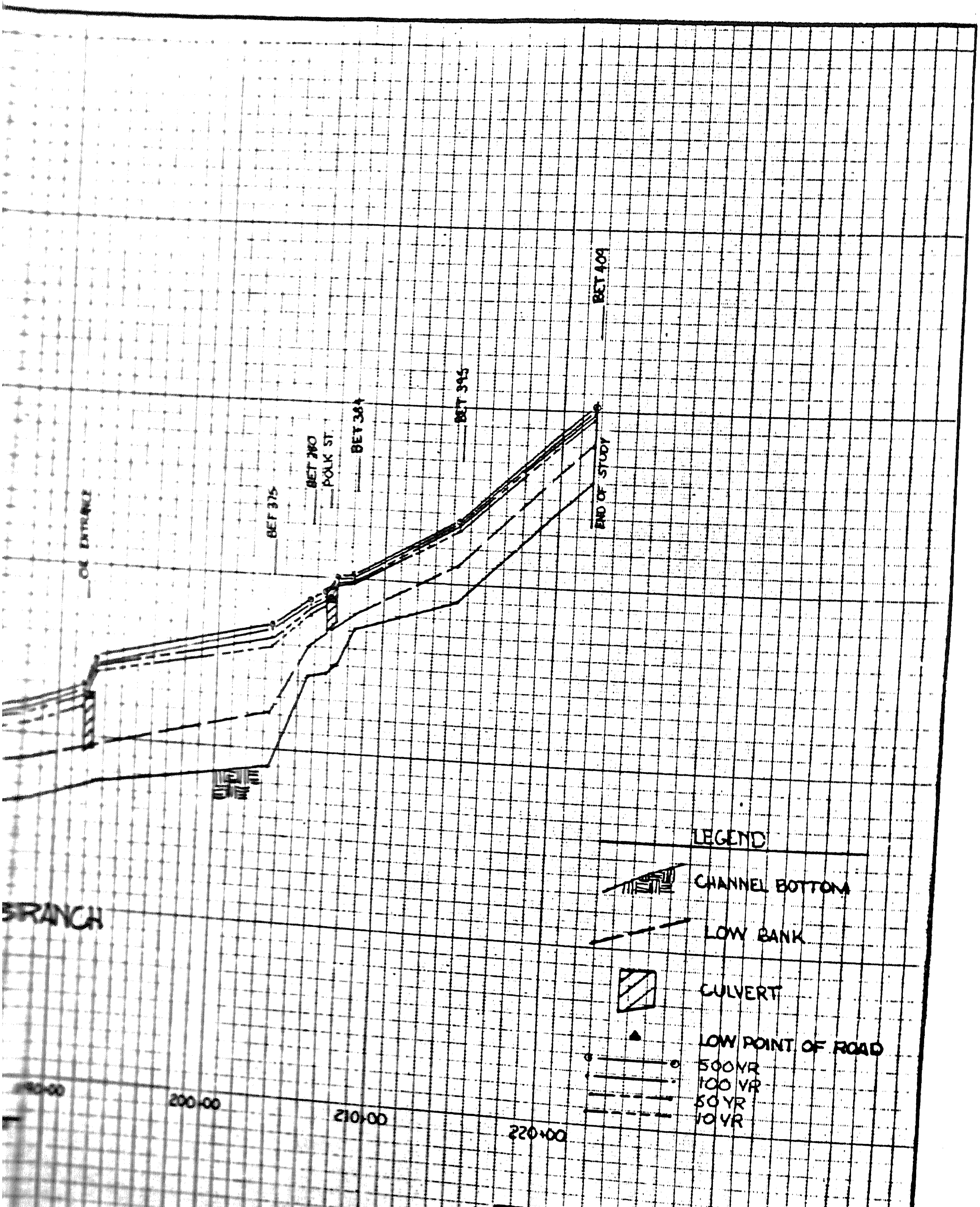


BUTTERFIELD CREEK
EAST BRANCH
PRESENT CONDITIONS
COOK COUNTY, ILLINOIS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	Date	Approved by
Drawn J Ehlen	10/86	Title
Traced		Title
Checked RM Bartels	12/86	Sheet No. 7 of 10 · Drawing No. APPENDIX A

SCS-ENG-316 (Rev. 6-73)



BUTTERFIELD CREEK
EAST BRANCH
PRESENT CONDITIONS
COOK COUNTY, ILLINOIS

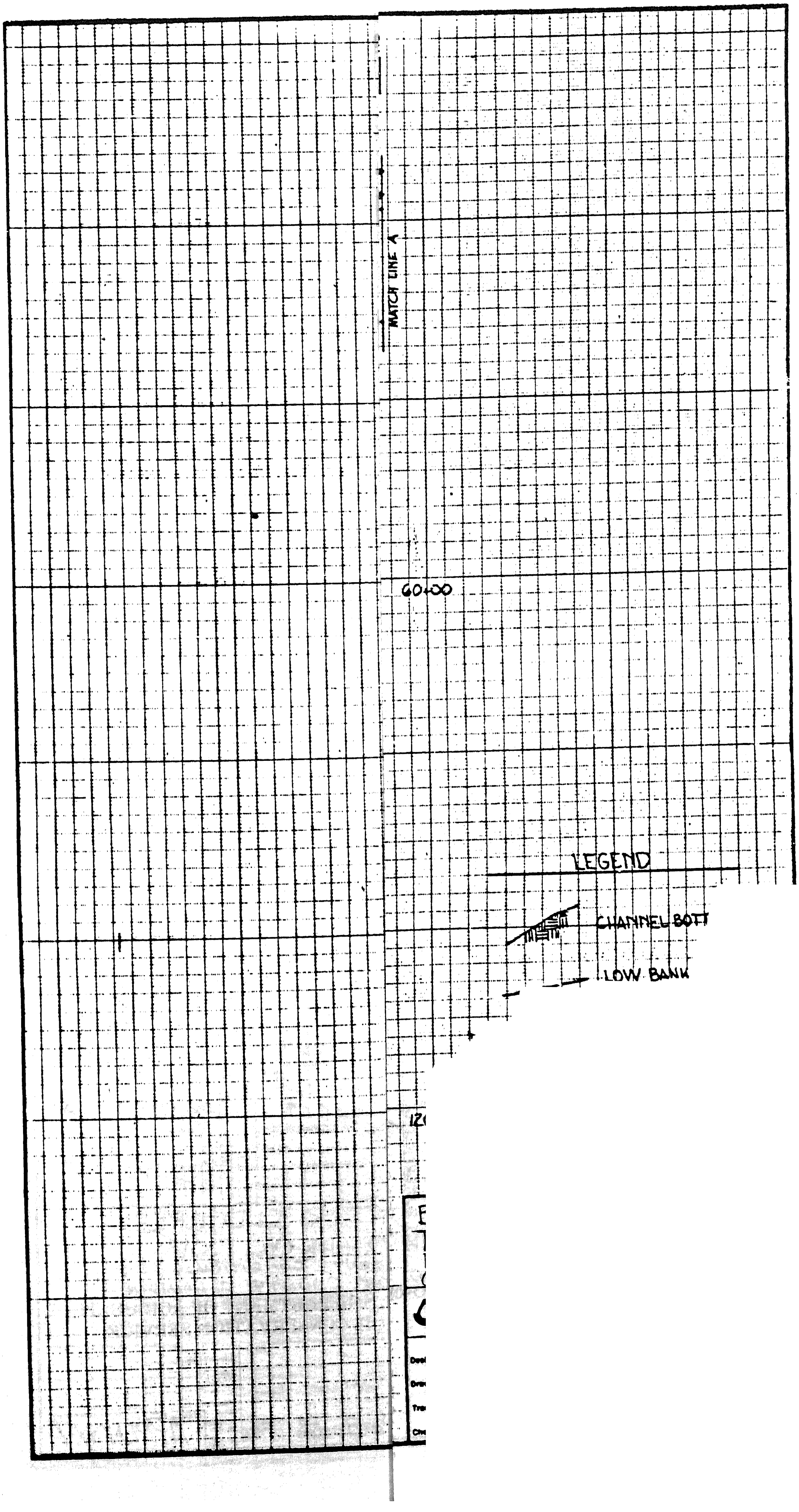
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

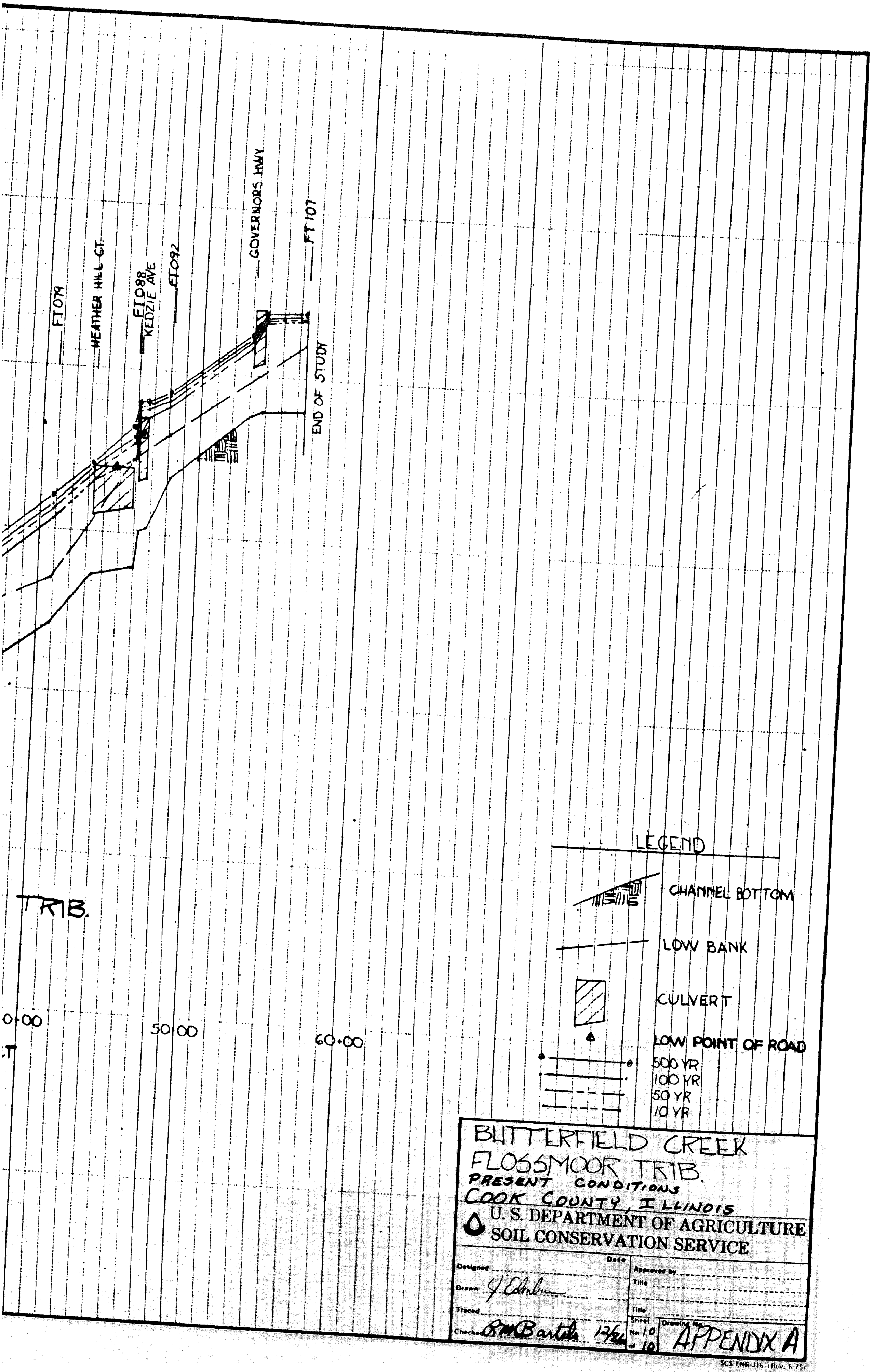
Designed | Date
Drawn J Edulen 11/85
Traced
Checked RM Bartels 12/85

Approved by
Title
Title

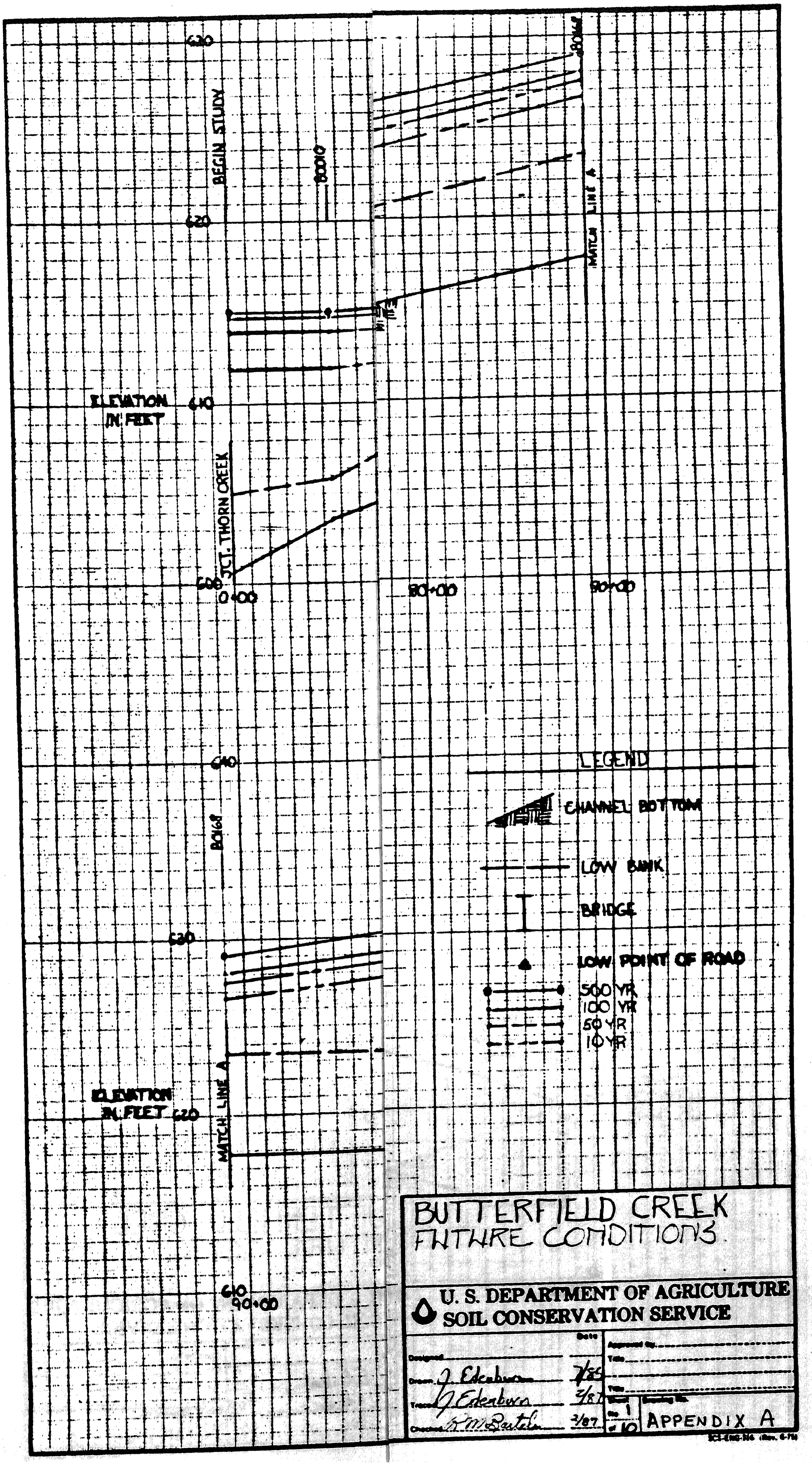
Sheet No. 8 of 10
Drawing No. APPENDIX A

SCS-ENG-316 (Rev. 6-73)


MATCH LINE A
60+00
LEGEND
CHANNEL BOTT
LOW BANK



FT079
WEATHER HILL CT.
FT088
KEDZIE AVE
FT092
GOVERNORS HWY.
FT107
END OF STUDY
TRIB.
0+00
50+00
60+00
LEGEND
CHANNEL BOTTOM
LOW BANK
CULVERT
LOW POINT OF ROAD
500 YR
100 YR
50 YR
10 YR
BUTTERFIELD CREEK
FLOSSMOOR TRIB.
PRESENT CONDITIONS
COOK COUNTY, ILLINOIS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Date
Designed
Approved by
Drawn Y. Edenburn
Title
Traced
Checked R.M. Bartels 12/86
Sheet No. 10 of 10
Drawing No. APPENDIX A
SCS ENG 316 (Rev. 6 75)

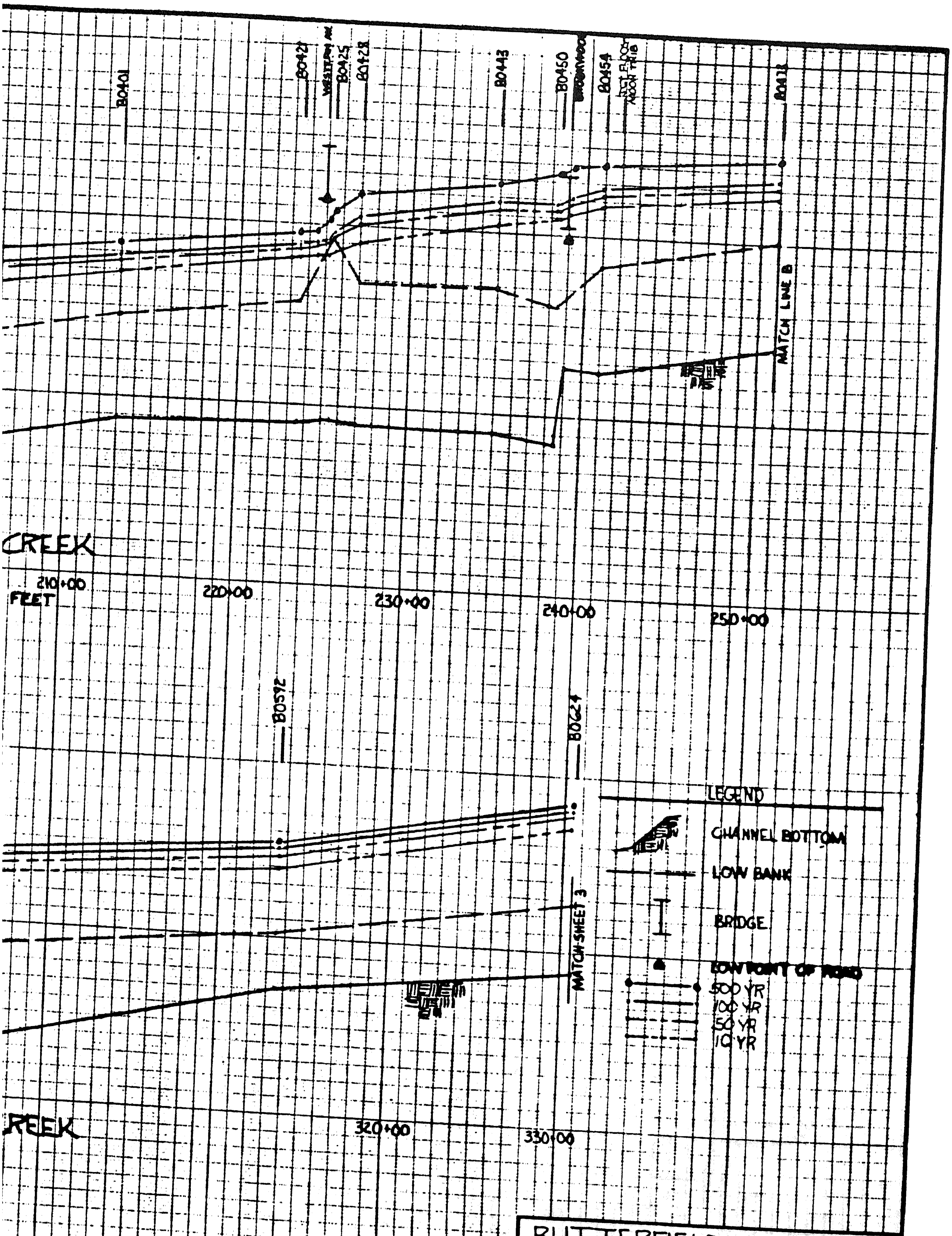


BUTTERFIELD CREEK
FUTURE CONDITIONS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date	
Designed			Approved by
Drawn	J. Edenburn	7/85	Title
Traced	J. Edenburn	3/87	Title
Checked	K.M. Bartels	3/87	Sheet No. 1 of 10 · Drawing No. APPENDIX A

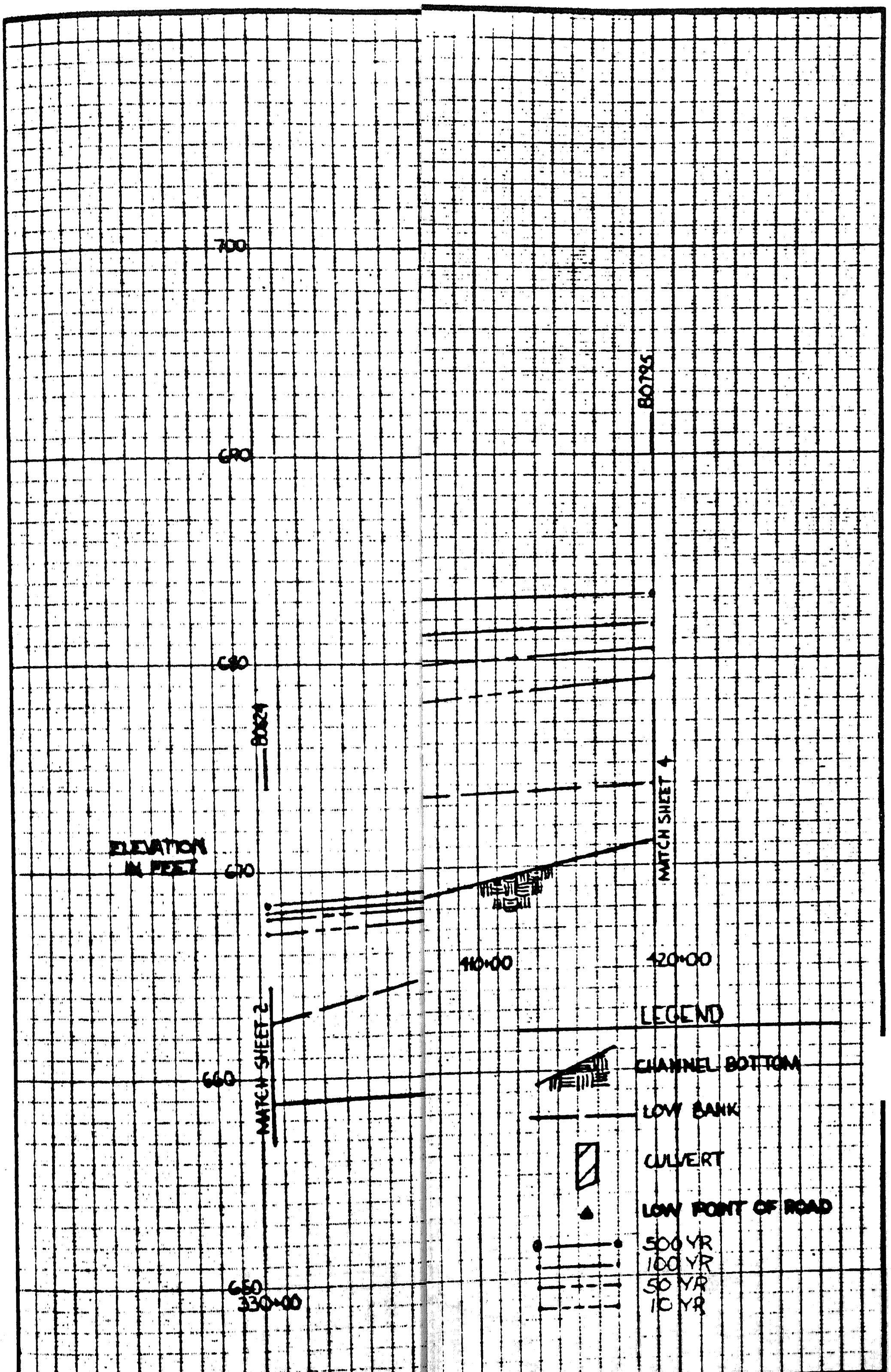
SCS-ENG-316 (Rev. 6-70)



BUTTERFIELD CREEK
FUTURE CONDITIONS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Drawn J. Edenburn 7/86
Traced J. Edenburn 4/87
Checked R.M. Santel 3/87
Sheet 2 of 10
APPENDIX A

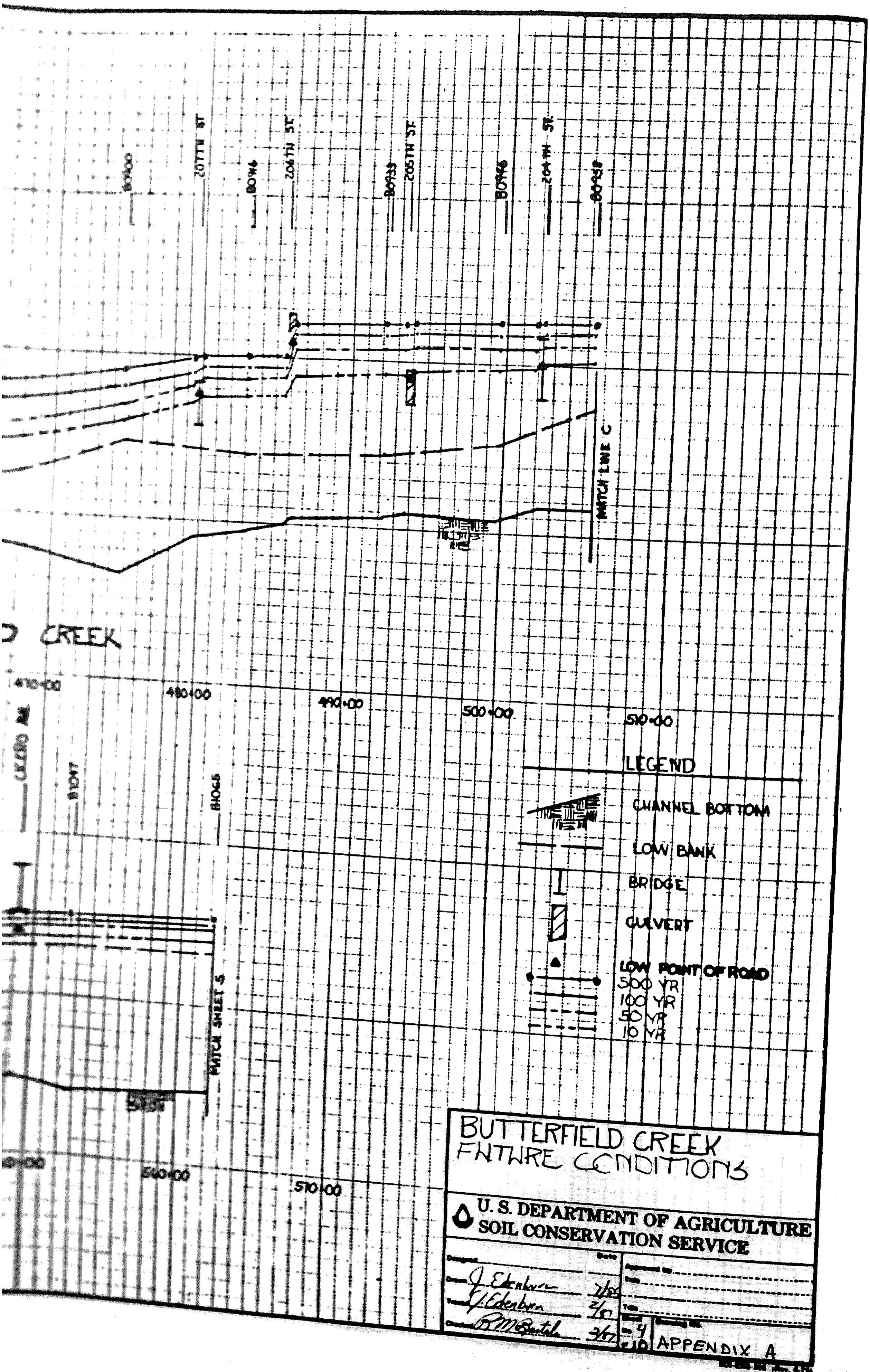


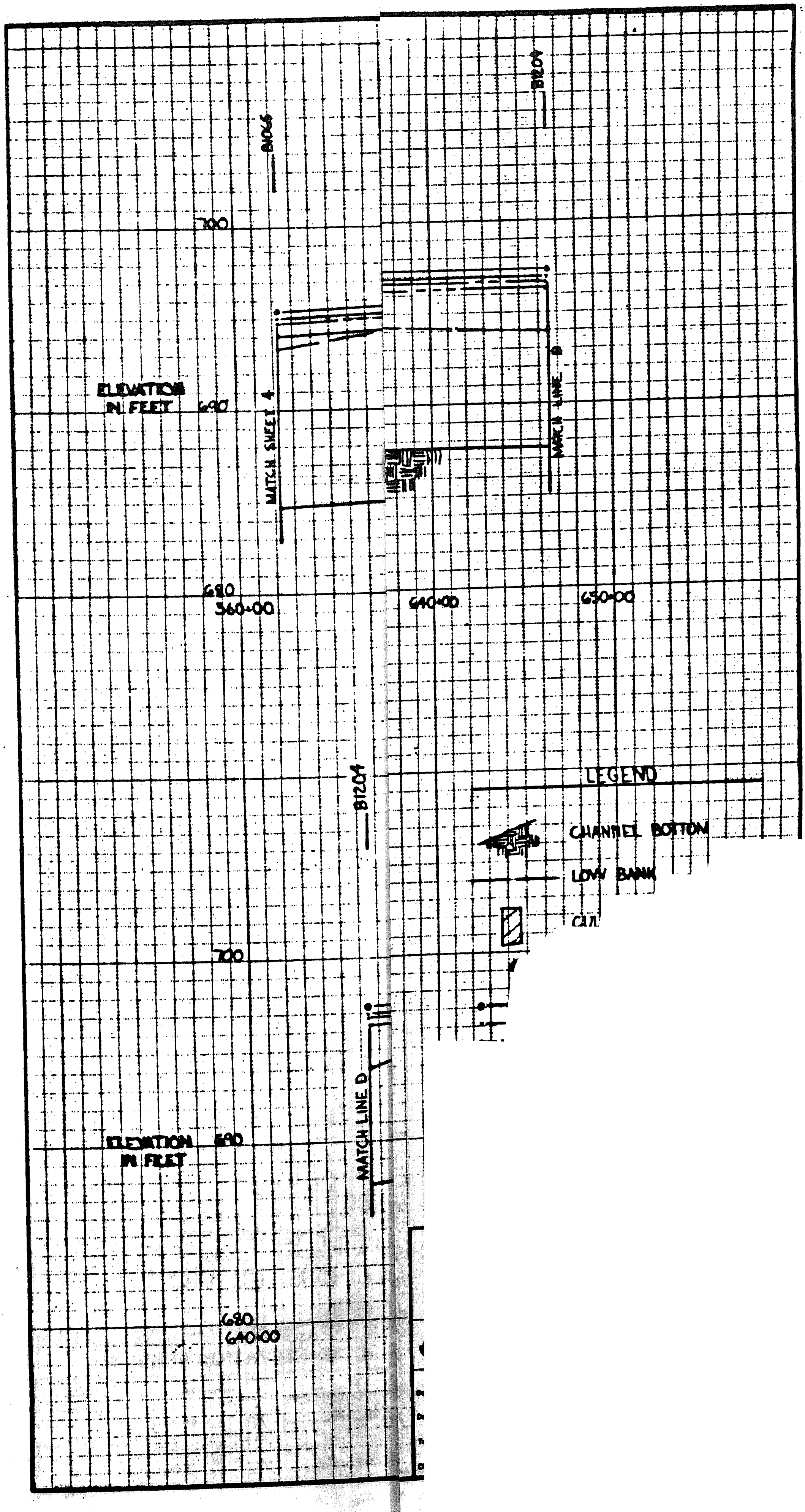
BUTTERFIELD CREEK
FUTURE CONDITIONS

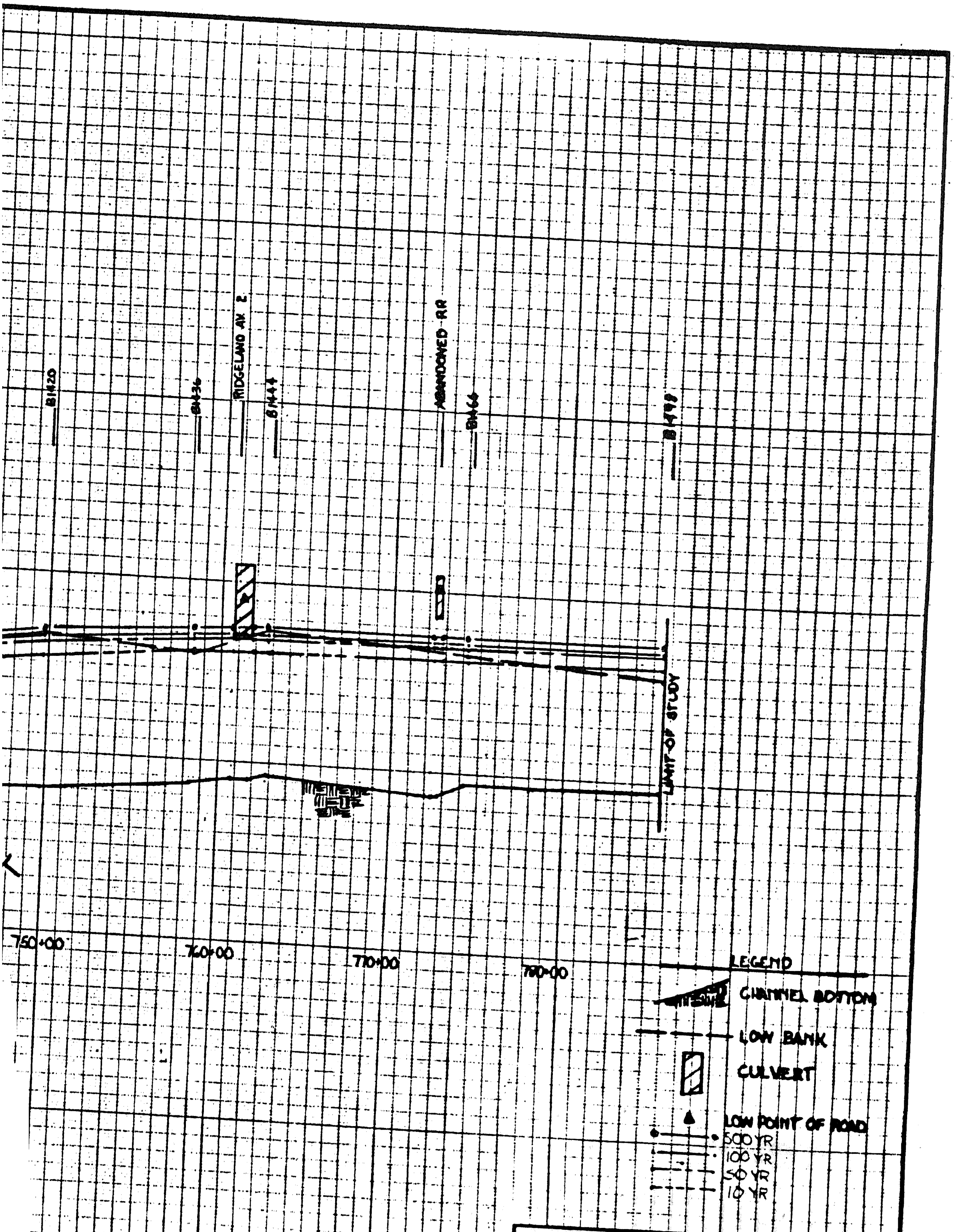
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

	Date		
Designed		Approved by	
Drawn J. Edenburn	7/85	Title	
Traced J. Edenburn	3/87	Title	
Checked R.M. Bartels	3/87	Sheet No. 3 of 10	Drawing No. APPENDIX A

SCS-ENG 316 (Rev. 6-75)


207TH ST
206TH ST
205TH ST
204TH ST
MATCH LINE C
CREEK
470+00
480+00
490+00
500+00
510+00
540+00
570+00
MATCH SHEET 5
LEGEND
CHANNEL BOTTOM
LOW BANK
BRIDGE
CULVERT
LOW POINT OF ROAD
500 YR
100 YR
50 YR
10 YR
BUTTERFIELD CREEK
FUTURE CONDITIONS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
APPENDIX A

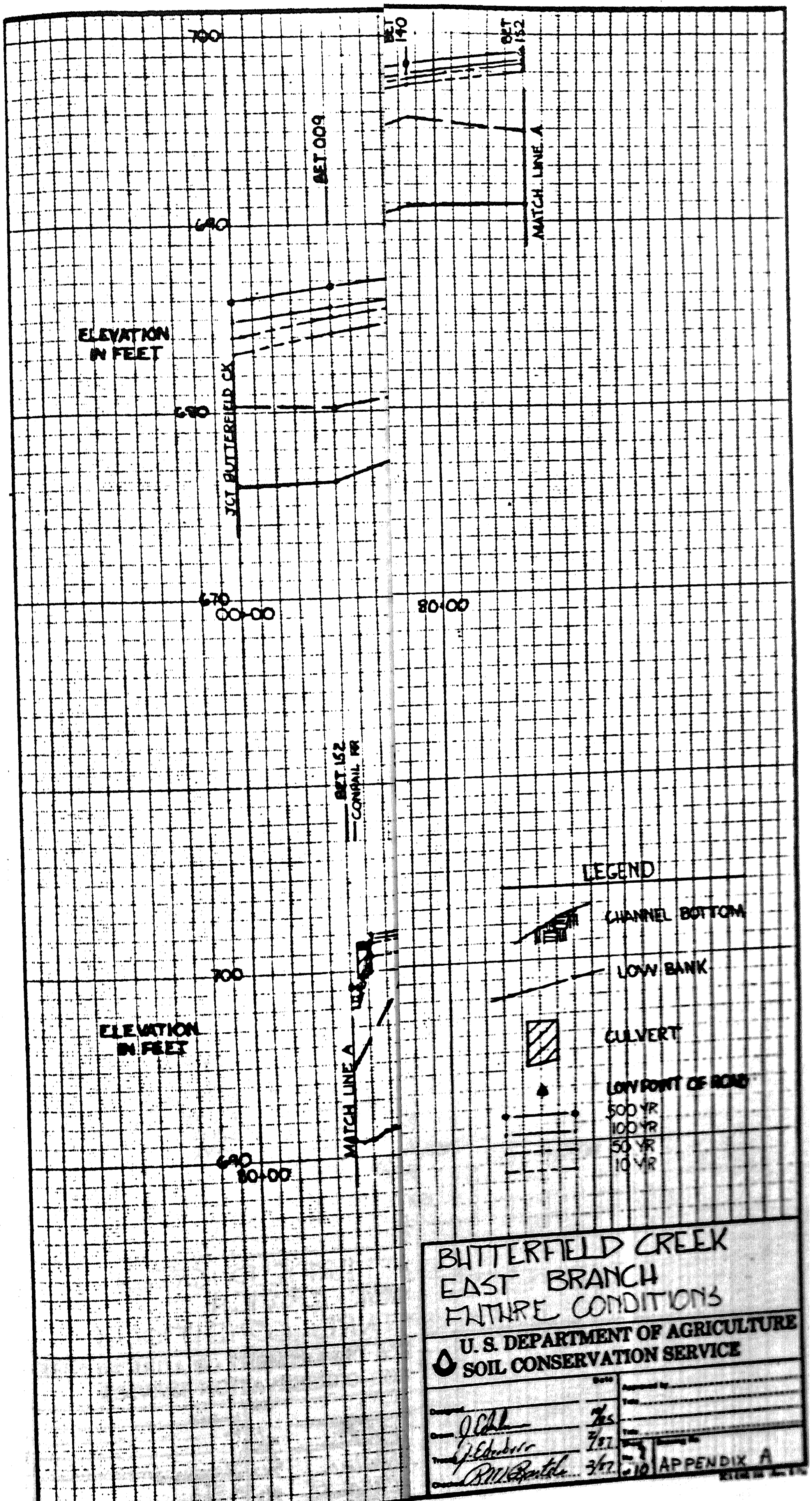

B1066
B1204
700
ELEVATION IN FEET
690
MATCH SHEET 4
MATCH LINE D
680
360+00
640+00
650+00
LEGEND
CHANNEL BOTTOM
LOW BANK
B1204
700
MATCH LINE D
ELEVATION IN FEET
690
680
640+00

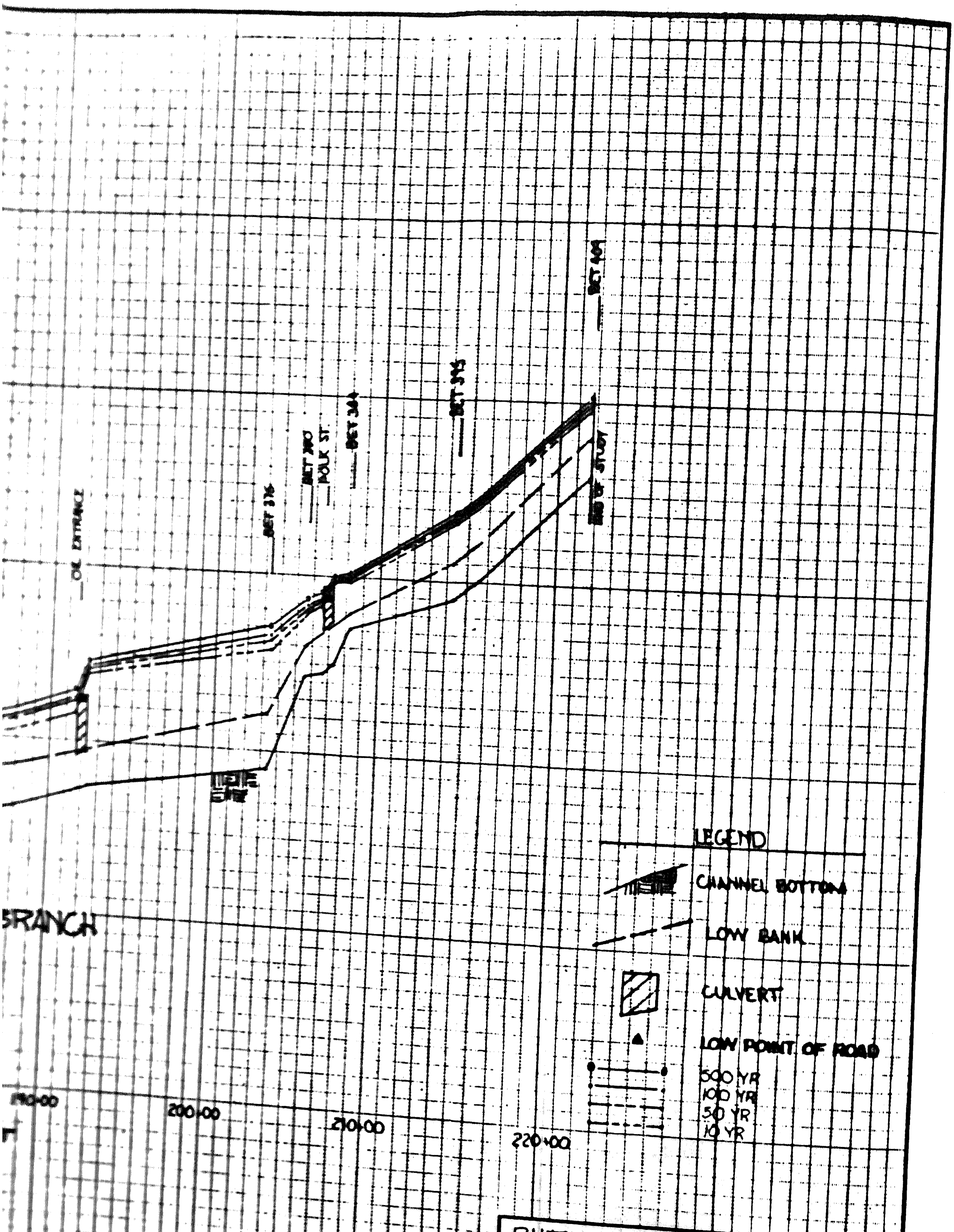


BUTTERFIELD CREEK
FUTURE CONDITIONS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date	
Designed			Approved by
Drawn	J. Edenburn	7/85	Title
Traced	J. Edenburn	2/87	Title
Checked	R.M. Bartels	3/87	Sheet 6 of 10 — Drawing No. APPENDIX A


700
BET 140
BET 152
BET 009
MATCH LINE A
690
ELEVATION IN FEET
680
JCT BUTTERFIELD CK
670
00+00
80+00
BET 152
CONRAIL RR
700
ELEVATION IN FEET
MATCH LINE A
690
80+00
LEGEND
CHANNEL BOTTOM
LOW BANK
CULVERT
LOW POINT OF ROAD
500 YR
100 YR
50 YR
10 YR
BUTTERFIELD CREEK
EAST BRANCH
FUTURE CONDITIONS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
APPENDIX A

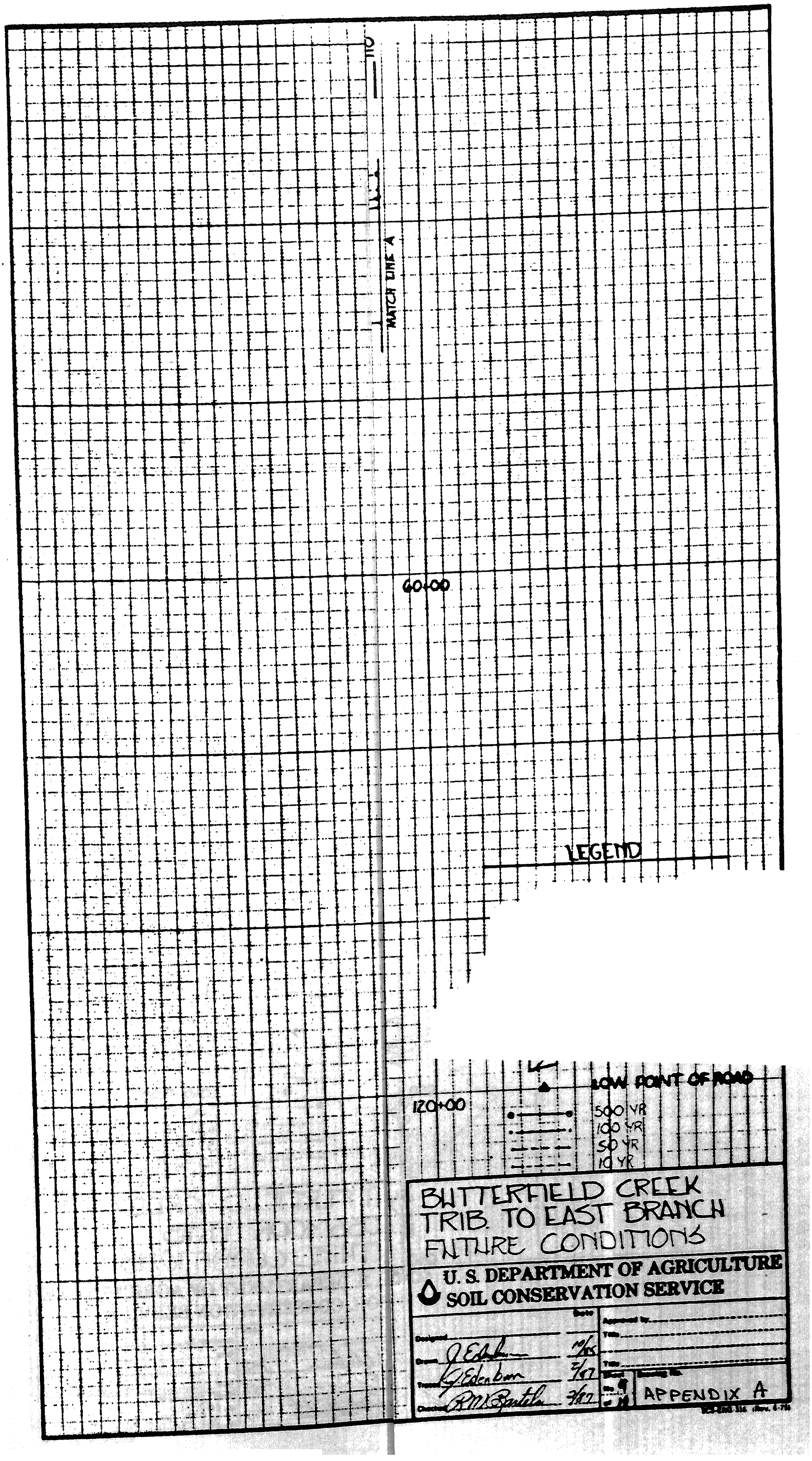


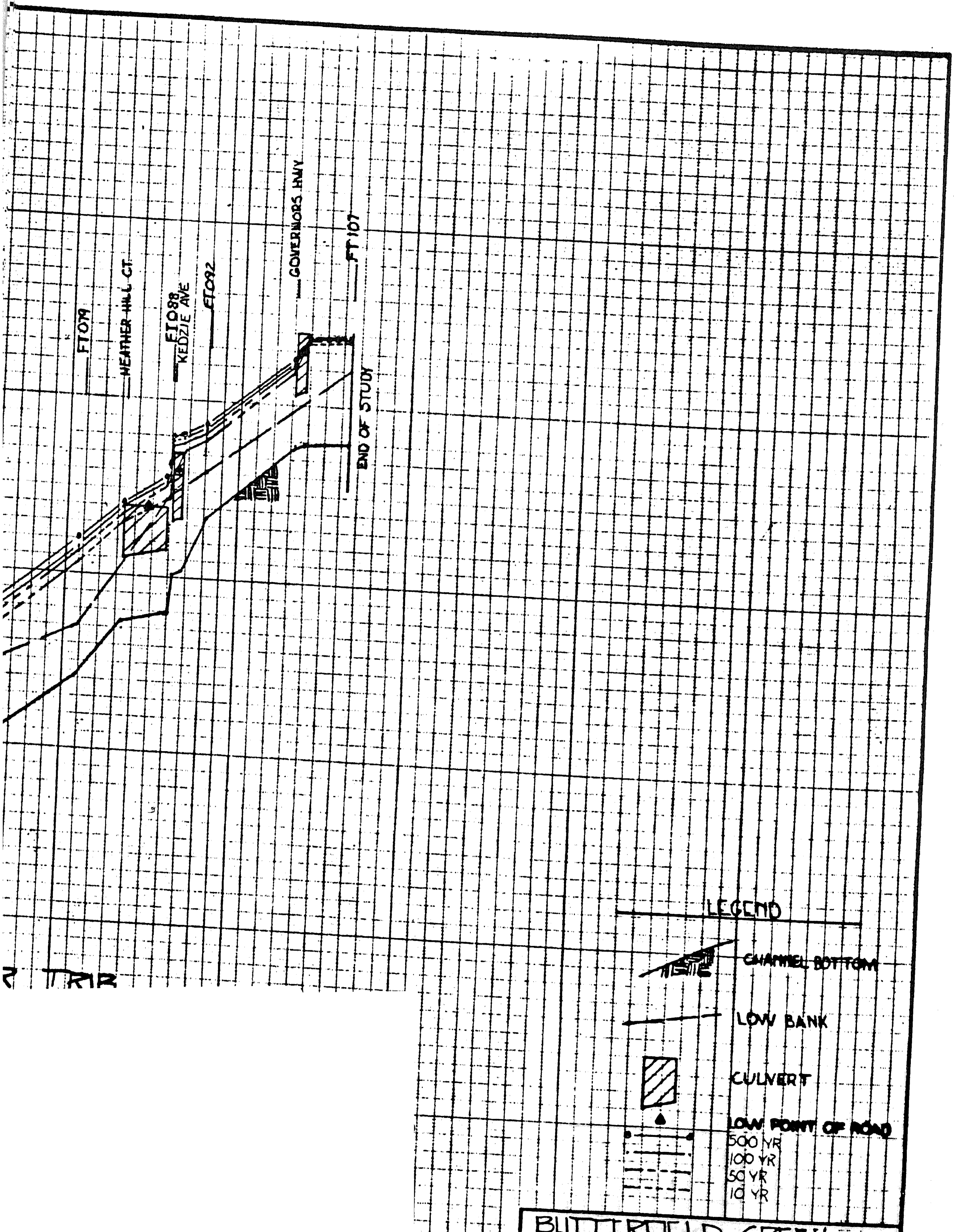
BUTTERFIELD CREEK
EAST BRANCH
FUTURE CONDITIONS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed		Date	Approved by
Drawn	J. Edeeburn	2/87	Title
Traced	J. Edeeburn	2/87	Date
Checked	R.M. Bartels	3/87	

Sheet 8 of 10 Drawing No. APPENDIX A

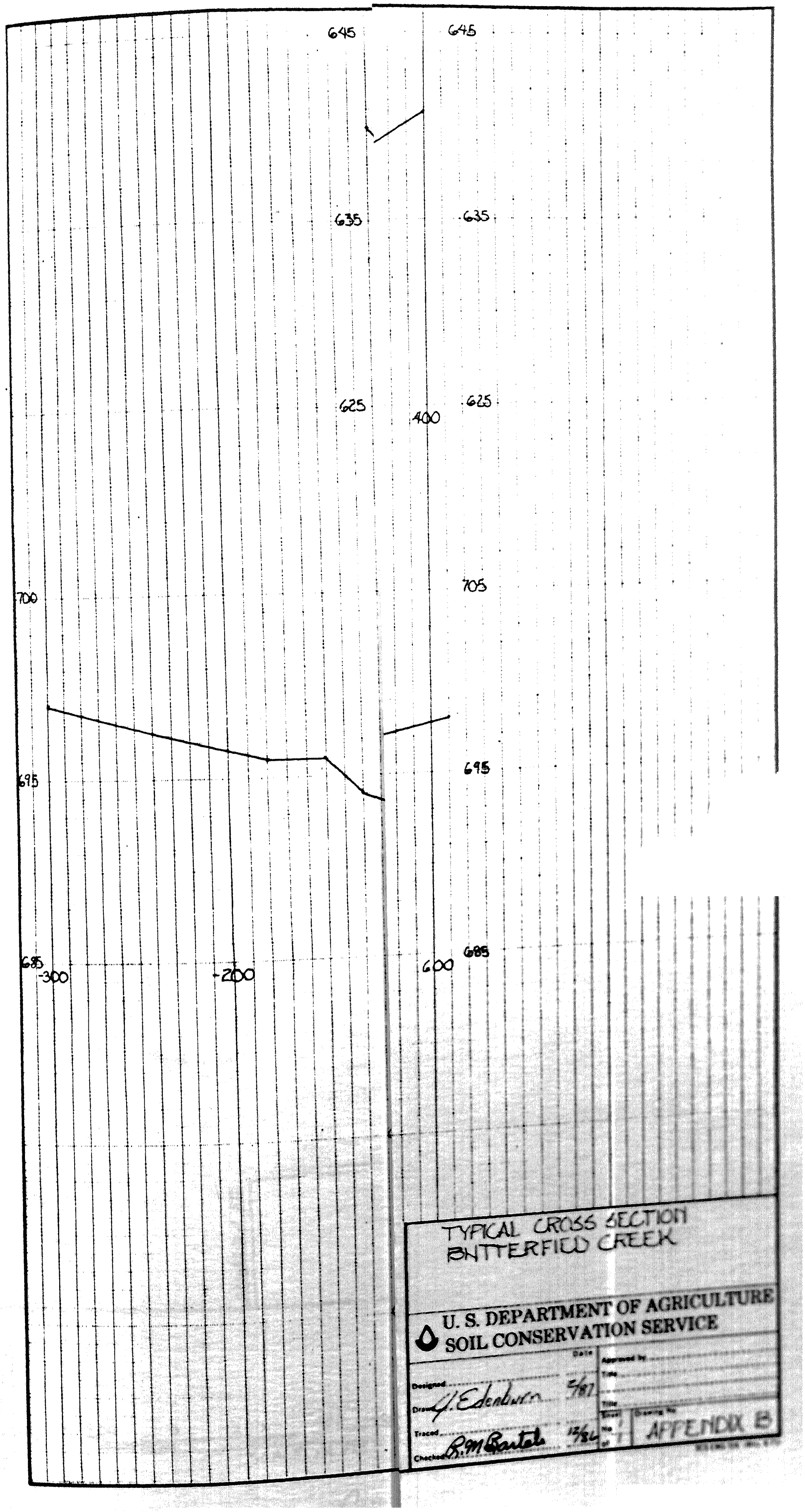

110
MATCH LINE A
60+00
LEGEND
LOW POINT OF ROAD
120+00
500 YR
100 YR
50 YR
10 YR
BUTTERFIELD CREEK
TRIB. TO EAST BRANCH
FUTURE CONDITIONS
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Date
Designed
Drawn
Traced
Checked
Approved by
Title
Sheet
Drawing No.
APPENDIX A

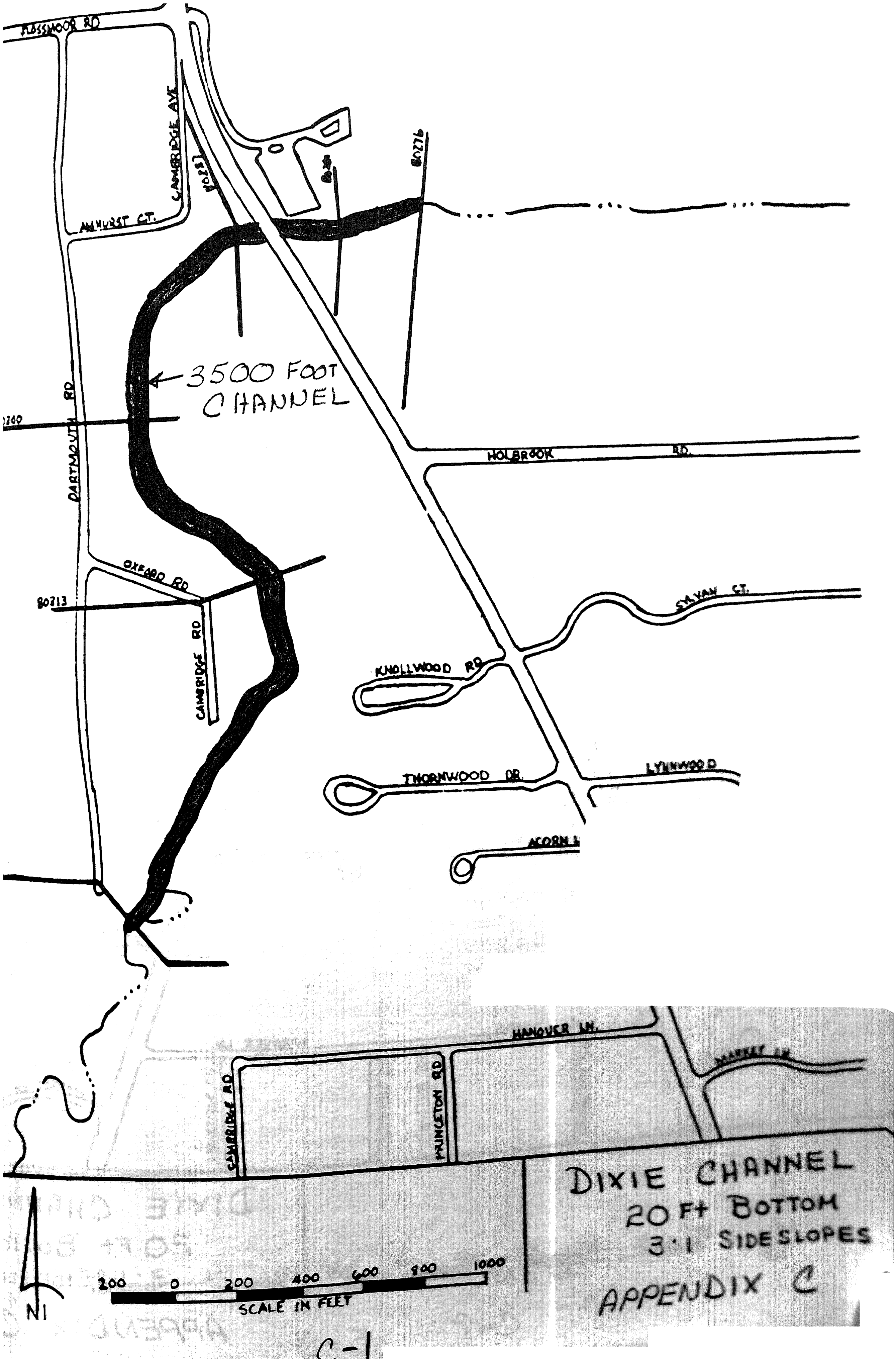


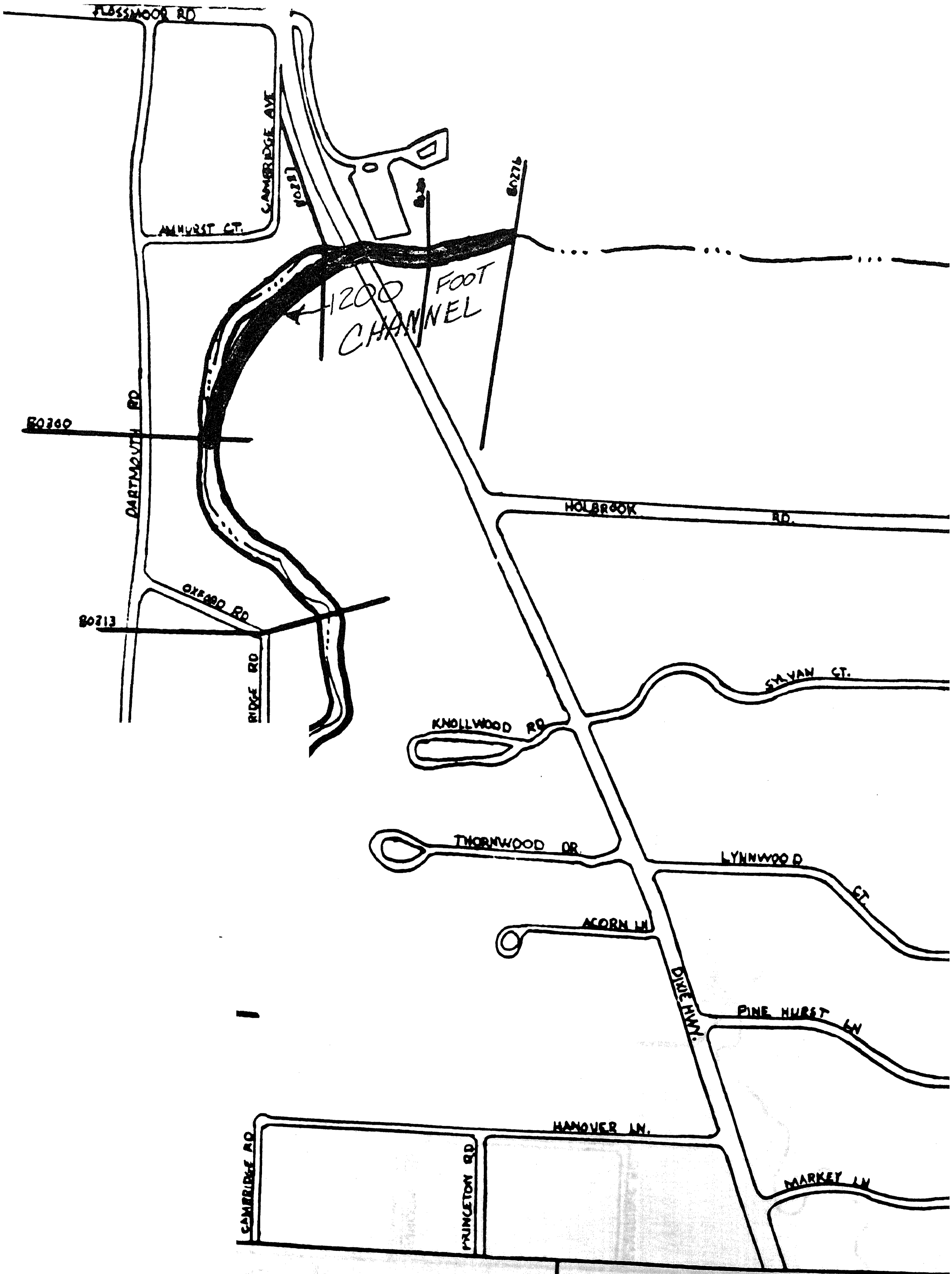
BUTTERFIELD CREEK
FLOSSMOOR TRIB.
FUTURE CONDITIONS

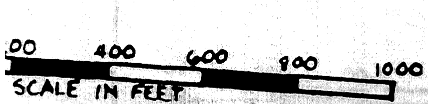
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date	
Designed			Approved by
Drawn	J. Edelson	1/87	Title
Traced	J. Edelson	2/87	Title
Checked	R.M. Bartels	2/87	Sheet No. 10 of 10 — Drawing No. APPENDIX A


645
645
635
635
625
400
625
700
705
695
695
685
-300
-200
600
685
TYPICAL CROSS SECTION
BUTTERFIELD CREEK
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Date
Approved by
Title
Designed
Drawn G. Edenburn 5/87
Traced
Checked R.M. Bartels 12/86
Sheet
No.
of
Drawing No.
APPENDIX B


FLOSSMOOR RD
CAMBRIDGE AVE
AMHURST CT.
80276
3500 FOOT
CHANNEL
DARTMOUTH RD
HOLBROOK RD.
OXFORD RD
80313
CAMBRIDGE RD
SYLVAN CT.
KNOLLWOOD RD
THORNWOOD DR.
LYNNWOOD
ACORN L
HANOVER LN.
MARKET LN
CAMBRIDGE RD
PRINCETON RD
DIXIE CHANNEL
20 Ft BOTTOM
3:1 SIDE SLOPES
APPENDIX C
200 0 200 400 600 800 1000
SCALE IN FEET
N

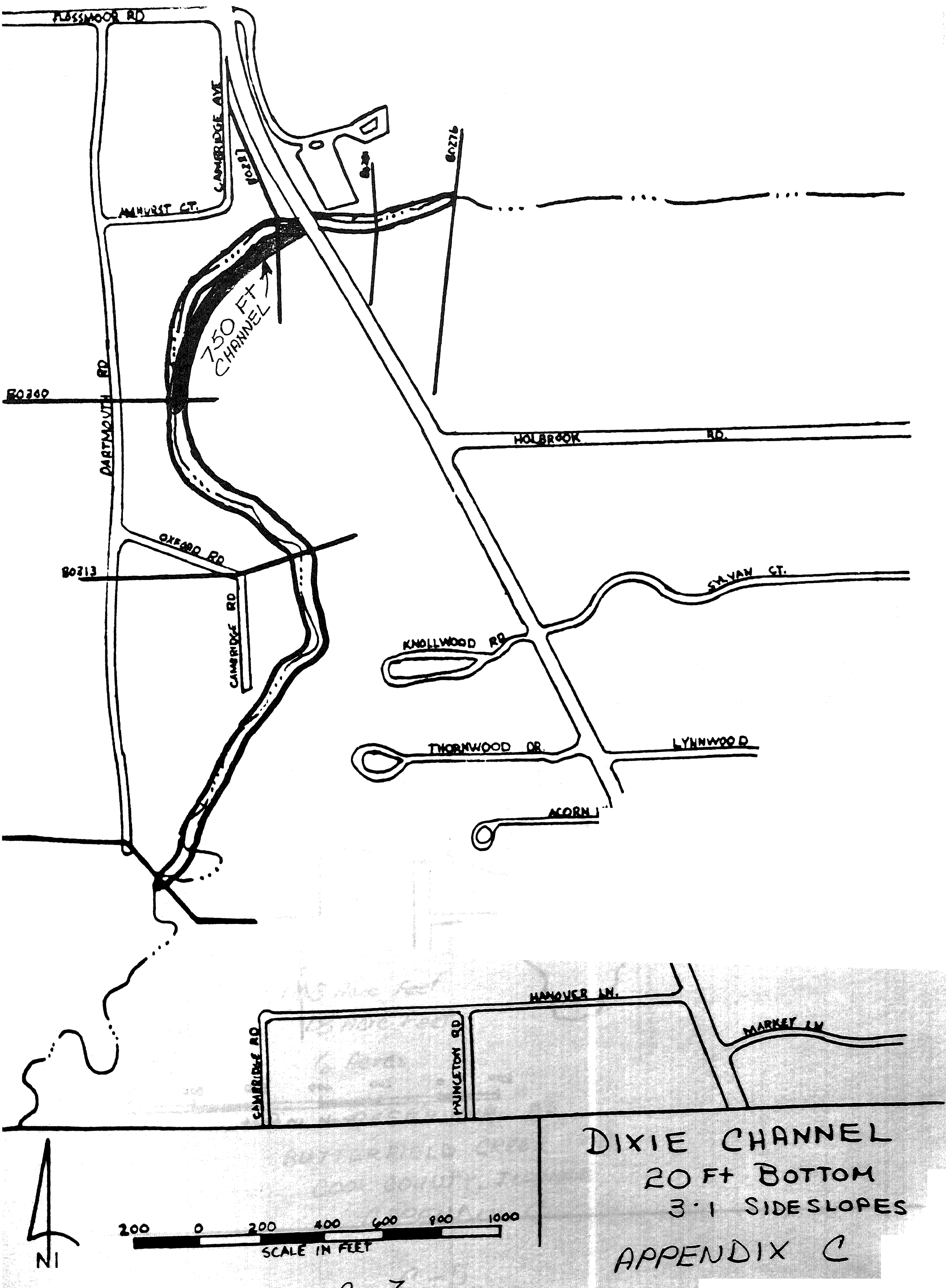


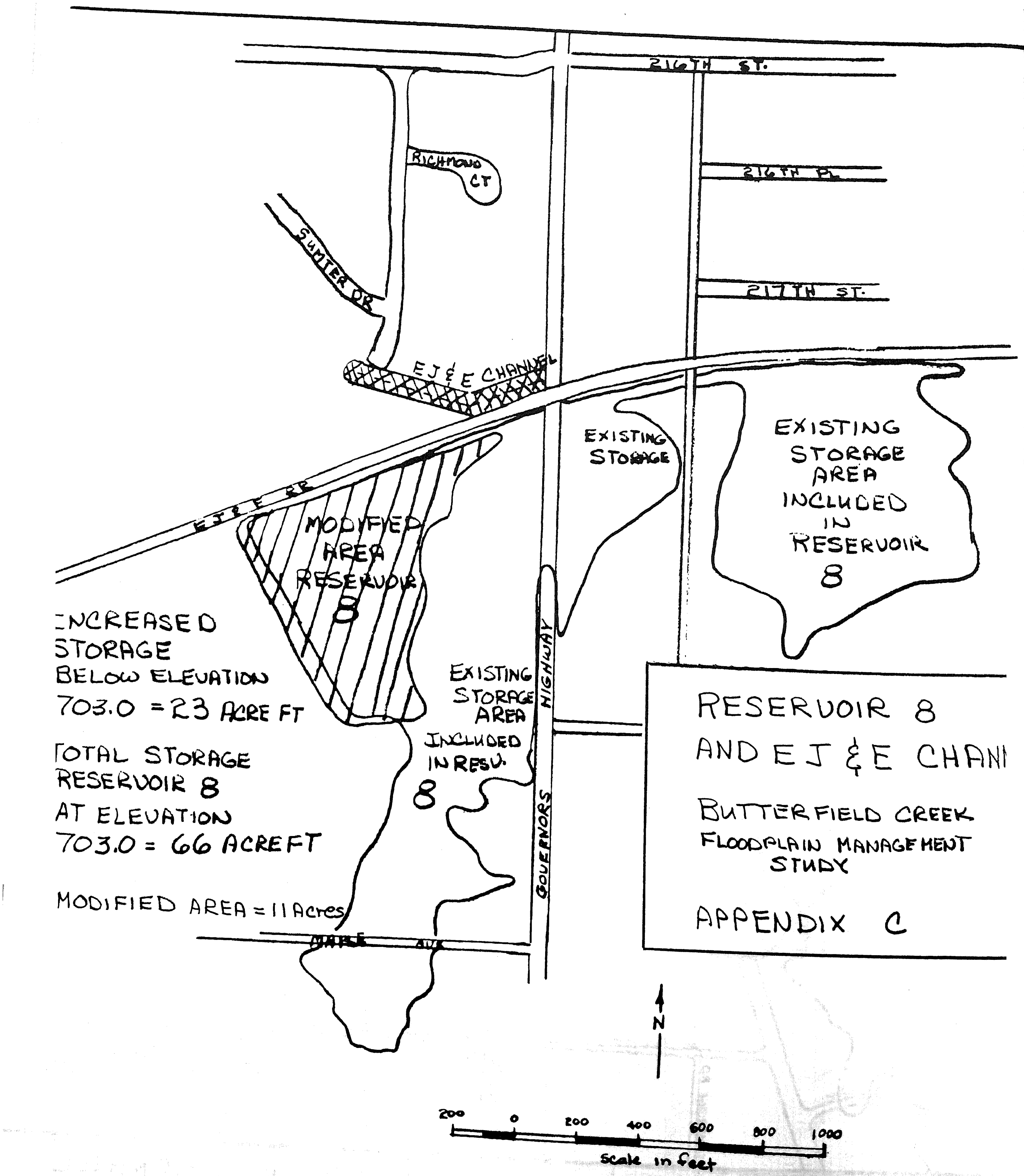


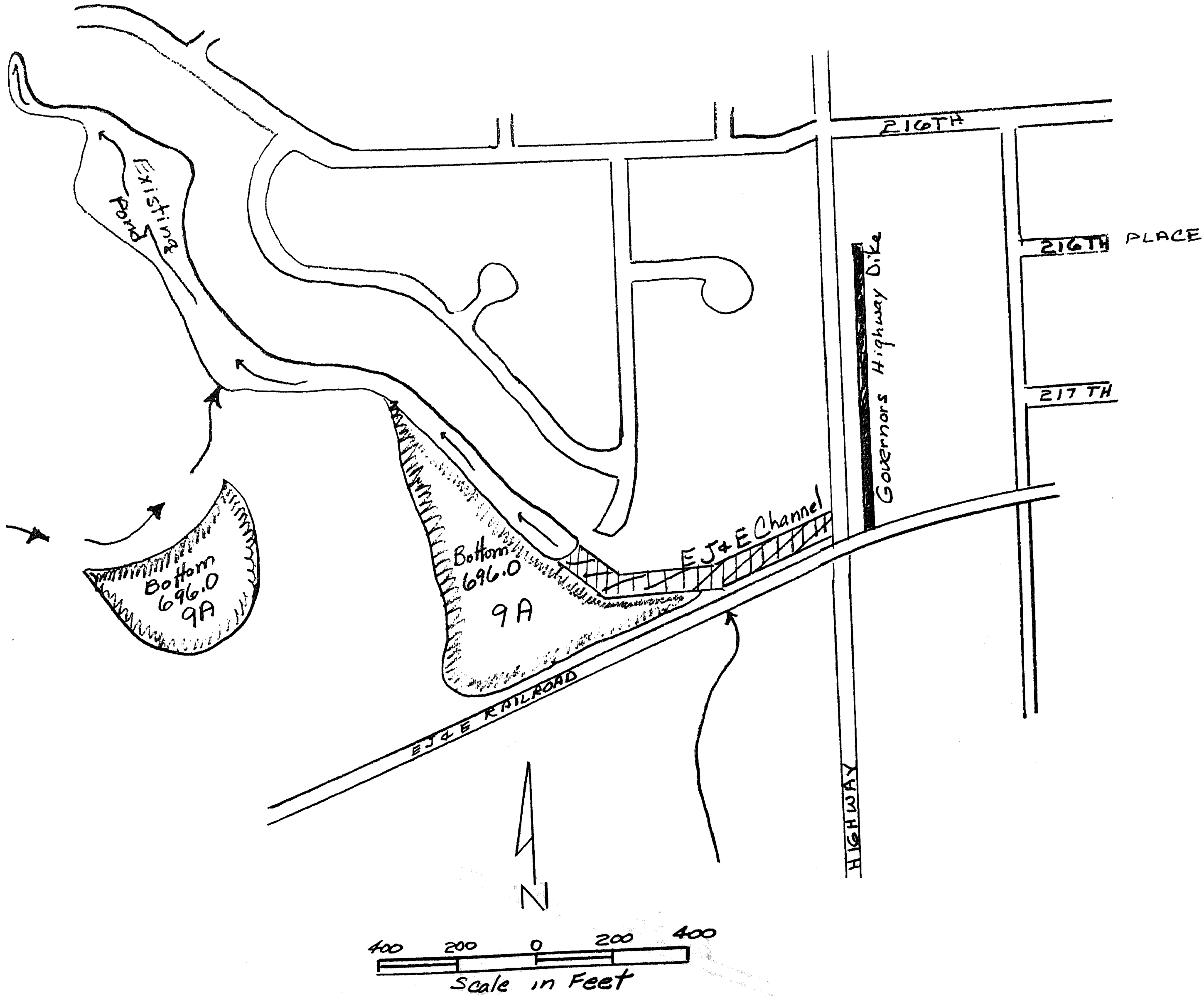
DIXIE CHANNEL
20 Ft BOTTOM
3:1 SIDESLOPES

C-2

APPENDIX C


FLOSSMOOR RD
CAMBRIDGE AVE
AMHURST CT.
B0281
B0276
750 Ft CHANNEL
B0300
DARTMOUTH RD
HOLBROOK RD.
OXFORD RD
B0313
CAMBRIDGE RD
SYLVAN CT.
KNOLLWOOD RD
THORNWOOD DR.
LYNNWOOD
ACORN
HANOVER LN.
CAMBRIDGE RD
PRINCETON RD
MARKEY LN
200 0 200 400 600 800 1000
SCALE IN FEET
N
DIXIE CHANNEL
20 Ft Bottom
3:1 SIDESLOPES
APPENDIX C

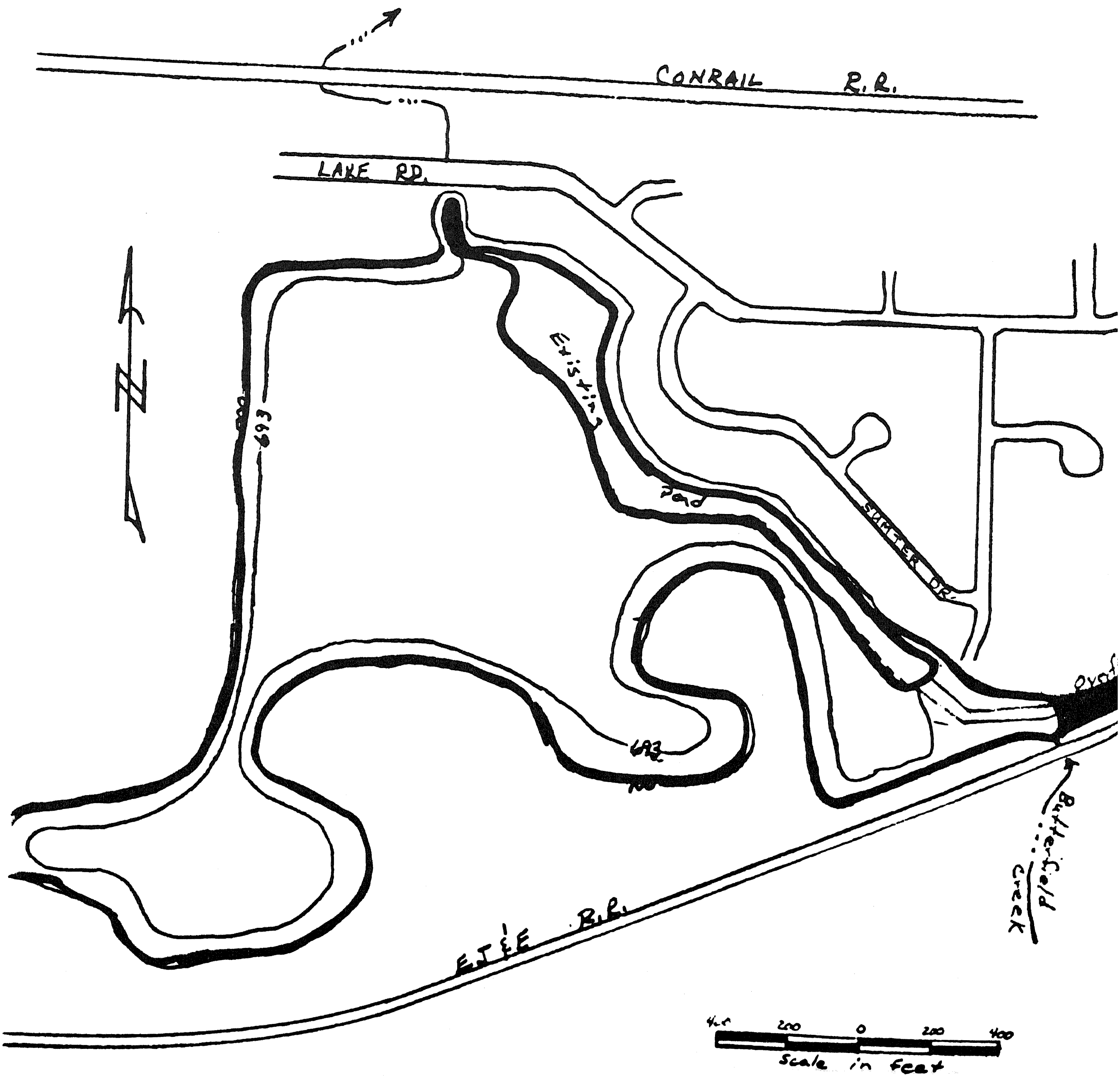

216TH ST.
RICHMOND CT
SUMTER DR
216TH PL.
217TH ST.
EJ & E CHANNEL
EJ & E RR
EXISTING STORAGE
EXISTING STORAGE AREA INCLUDED IN RESERVOIR 8
MODIFIED AREA RESERVOIR 8
INCREASED STORAGE BELOW ELEVATION 703.0 = 23 ACRE FT
TOTAL STORAGE RESERVOIR 8 AT ELEVATION 703.0 = 66 ACREFT
MODIFIED AREA = 11 Acres
EXISTING STORAGE AREA INCLUDED IN RESV. 8
GOVERNORS HIGHWAY
MAPLE AVE
RESERVOIR 8
AND EJ & E CHANN
BUTTERFIELD CREEK
FLOODPLAIN MANAGEMENT
STUDY
APPENDIX C
N
200 0 200 400 600 800 1000
Scale in feet



low Elevation 700

OTAL STORAGE	168 Acre Feet
DD'L STORAGE	18 Acre Feet
ND RIGHTS	6 Acres

RESERVOIR 9A
BUTTERFIELD CREEK W/S
COOK COUNTY, ILLINOIS
APPENDIX C



BELOW ELEV. 700.0

TOTAL STORAGE	410 Ac. Ft.
ADD'L STORAGE	260 Ac. Ft.
DEPTH	7 Ft.
LAND RIGHTS	41 Ac.

RESERVOIR 16
BUTTERFIELD CREEK W/S
COOK COUNTY, ILLINOIS

APPENDIX C

APPENDIX D

Butterfield Creek and Tributaries

FLOODPLAIN MANAGEMENT STUDY

STRUCTURAL ELEMENTS EVALUATED

This Appendix gives the background information about all structural elements included in the report and the costs used for flood proofing. The following cost estimate sheets identify the quantities and unit prices used to obtain the cost estimates used in the evaluation. A verbal description of each of these structures is included in the main body of the report. The land rights prices reflect current zoning.

APPENDIX D
BUTTERFIELD CREEK WATERSHED
FLOODPLAIN MANAGEMENT STUDY
ALTERNATIVE B
COST ESTIMATE

Item	Quantity	Unit Price	Total Price
Floodproofing (25 year frequency)	40 buildings	$3200/buldg	$128,000

Construction cost =	$128,000
Average annual cost (.08875) = (8 7/8 for 100 yrs)	$ 11,360
O&M ($56/buldg) =	$ 2,240
Flood warning system = (annual cost)	$ 3,000
Total annual cost =	$ 16,600

APPENDIX D
BUTTERFIELD CREEK WATERSHED
FLOODPLAIN MANAGEMENT STUDY
COST ESTIMATE
Dixie Channel (3500 ft)

Item	Quantity	Unit Price	Total Price
new bridge @ sta 146+50	1 job	1 lump sum	$ 23,000
new bridge @ sta 149+00	1 job	1 lump sum	96,000
new bridge @ sta 159+00	1 job	1 lump sum	13,000
Excavation	16,400 cu yds	$5.50/cu yds	90,200
Seed, fertilize & mulch	8.0 acres	$3,000/acre	24,000
		Subtotal	$ 246,200
	10% Contingency		24,600
		Total	$ 270,800

Construction cost	$270,800
Engr Services & Proj Admin (20% of constr cost)	54,200
Land rights: 8.0 acre @ $40,000/ac	320,000
Installation cost =	645,000
Average annual cost (.08875) (8 7/8% for 100 yrs)	57,200
O&M	1,700
Annual cost	$58,900

Note: Does not include costs for utility relocation or any bank protection.

APPENDIX D
BUTTERFIELD CREEK WATERSHED
FLOODPLAIN MANAGEMENT STUDY
COST ESTIMATE
Dixie Channel (1200 ft)

Item	Quantity	Unit Price	Total Price
new bridge @ sta 146+50	1 job	1 lump sum	$ 23,000
new bridge @ sta 149+00	1 job	1 lump sum	96,000
new bridge @ Dixie Hwy	1 job	1 lump sum	124,800
new bridge @ sta 159+00	1 job	1 lump sum	13,000
Excavation	11,150 cu yds	$5.50/cu yds	61,300
Clear and grub	1.7 acres	$5000/acre	8,500
Seed, fertilize & mulch	3.0 acres	$3,000/acre	9,000
		Subtotal	$ 335,600
	10% Contingency		33,600
		Total	$ 369,200

Construction cost	$369,200
Engr services & Proj Admin	73,800
Land Rights	120,000
Installation cost	563,000
Average annual cost (.08875)	50,000
O&M	1,700
Annual cost	51,700

APPENDIX D
BUTTERFIELD CREEK WATERSHED
FLOODPLAIN MANAGEMENT STUDY

COST ESTIMATE
Dixie Channel (750 ft)

tem	Quantity	Unit Price	Total Price
ew bridge @ sta 159+00	1 job	1 lump sum	13,000
xcavation	7,740 cu yds	$5.50/cu yds	42,570
lear & grub	1.7 acres	$5000/ac	8,500
eed, fertilize & mulch	1.7 acres	$3,000/acre	5,100
		Subtotal	$ 69,170
	10% Contingency		6,920
		Total	$ 76,090

:onstruction cost	$ 76,090
:ngr services & Proj Admin	15,210
.and Rights	68,000
:nstallation cost	159,300
\verage annual cost (.08875)	14,140
)&M	1,160
Annual cost	15,300

APPENDIX D
BUTTERFIELD CREEK WATERSHED
FLOODPLAIN MANAGEMENT STUDY
COST ESTIMATE
Reservoir 8

Item	Quantity	Unit Price	Total Price
Excavation	57,260 cu yds	$3.00/cu yds	171,780
Seed, fertilize & mulch	14 acres	$3,000/acre	42,000
		Subtotal	$213,780
	10% Contingency		21,380
		Total	$235,160

Construction cost	$235,160	
Engr services & Proj Admin	47,030	
Land Rights	70,000	
Installation cost	352,190	(use 352,200)
Average annual cost (.08875)	31,260	(8 7/8% for 100 years)
OM&R	740	
Annual cost	32,000	

APPENDIX D
BUTTERFIELD CREEK WATERSHED
FLOODPLAIN MANAGEMENT STUDY
COST ESTIMATE
Reservoir 9A

:em	Quantity	Unit Price	Total Price
:cavation	39,500 cu yds	$2.25/cu yds	88,875
ɜed, fertilize & mulch	6 acres	$3,000/acre	18,000
ɜmp seeding of spoil	10 acres	$900/acre	9,000
		Subtotal	$115,875
	10% Contingency		11,590
		Total	127,465

onstruction cost	$127,465	
ngr services & Proj Admin	25,495	
and Rights		
6 ac @ $20,000	120,000	
10 ac @ $ 3,000	30,000	
:nstallation cost	302,960	(use 303,000)
Average annual cost (.08875)	26,900	(8 7/8% for 100 years)
ƆM&R	600	
Annual cost	27,500	

Note: The 10 acres are for placement of spoil and will be returned to original owner after construction.

APPENDIX D
BUTTERFIELD CREEK WATERSHED
FLOODPLAIN MANAGEMENT STUDY
COST ESTIMATE
Reservoir 16

Item	Quantity	Unit Price	Total Price
Excavation	513,000 cu yds	$2.25/cu yds	1,154,250
Rock riprap (SW inlet)	900 cu yds	$80/cu yds	72,000
Seed, fertilize & mulch	41 acres	$3,000/acre	123,000
Temporary seeding	53 acres	$900/acre	47,700
		Subtotal	1,396,950
	10% Contingency		139,700
		Total	1,536,650

Construction cost	$1,536,650	
Engr services & Proj Admin	307,350	(20% of Construction Cost)
Land Rights		
41 acres @ $20,000/ac	820,000	
54 acres @ $ 3,000/ac	162,000	
Installation cost	2,826,000	
Average annual cost (.08875)	250,800	(8 7/8% for 100 years)
OM&R	2,000	
Total Annual cost	252,800	

Note: The 54 acres are for placement of spoil. The land will be returned to the owner following construction.

APPENDIX D
BUTTERFIELD CREEK WATERSHED
FLOODPLAIN MANAGEMENT STUDY
COST ESTIMATE
Governor's Highway Dike

n	Quantity	Unit Price	Total Price
thfill	585 cu yds	$5.00/cu yds	$2,925
d, fertilize & mulch	1 acre	$3,000/acre	3,000
		Subtotal	$5,925
	10% Contingency		595
		Total	$6,520

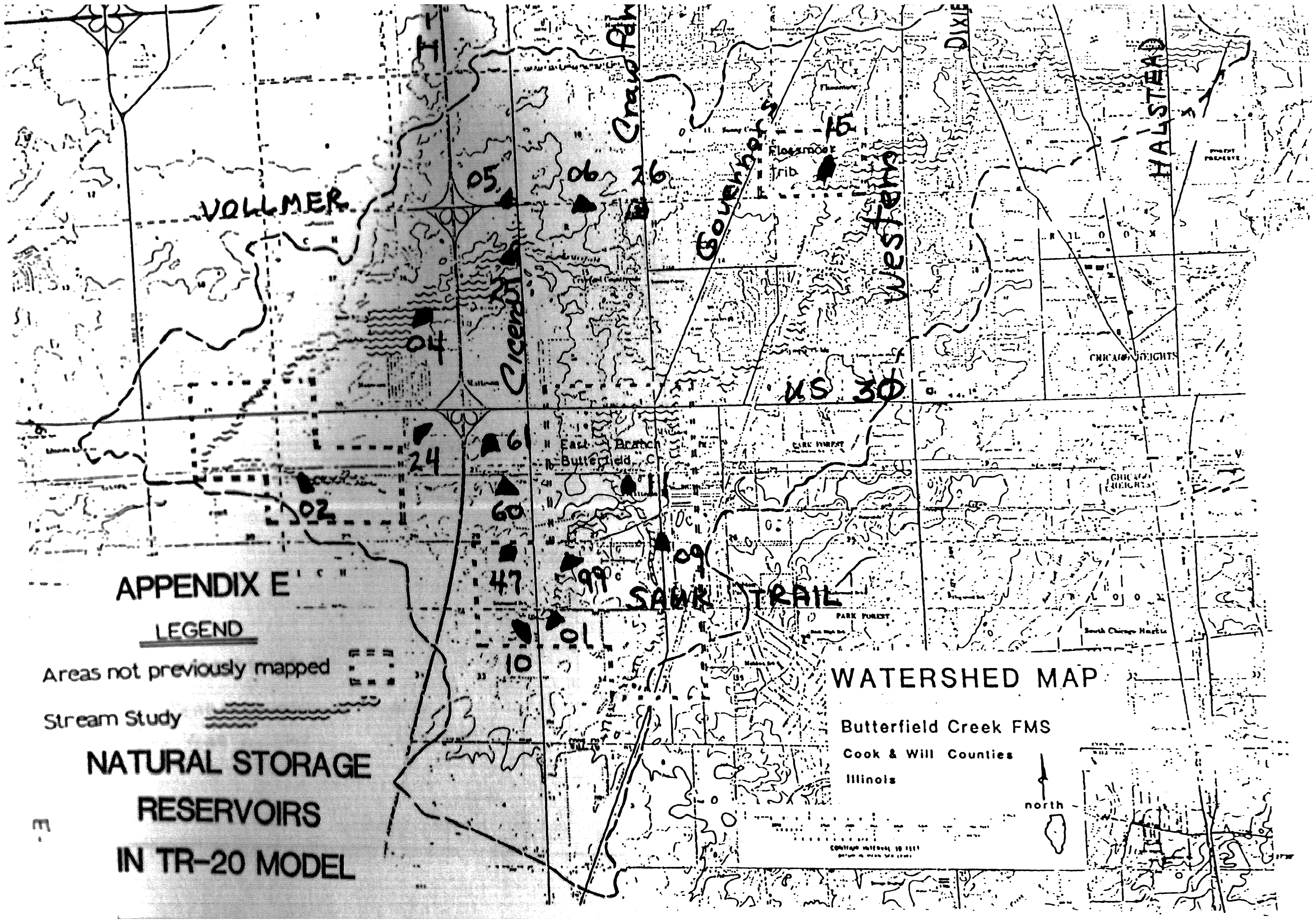
struction cost	$ 6,520	
r services & Proj Admin	1,340	(20% of construction cost)
d Rights	20,000	(use $28,000)
tallation cost	27,860	
erage annual cost (.08875)	2,490	(8 7/8% for 100 years)
&R	310	
nual cost	2,800	

APPENDIX D
BUTTERFIELD CREEK WATERSHED
FLOODPLAIN MANAGEMENT STUDY
COST ESTIMATE
EJ&E Channel

Item	Quantity	Unit Price	Total Pric
Excavation	5120 cu yds	$3.00/cu yds	$15,360
Rock riprap	700 cu yds	$80/cu yd	56,000
Seed, fertilize & mulch	1 acre	$3,000/acre	3,000
		Subtotal	$74,360
	10% Contingency		7,440
		Total	$81,800

Construction cost	$81,800	
Engr services & Proj Admin	16,400	
Land Rights	20,000	
Installation cost	118,200	
Average annual cost (.08875)	10,490	(8 7/8% for 100 years)
OM&R	710	
Annual cost	11,200	

Note: When the EJ&E Channel is constructed with Reservoir 16, the level section is at elevation 698.0. This increases the excavation to 5430 cu The revised construction cost is $82,800 and the revised installation cos $119,400. The new total annual cost is $11,300.



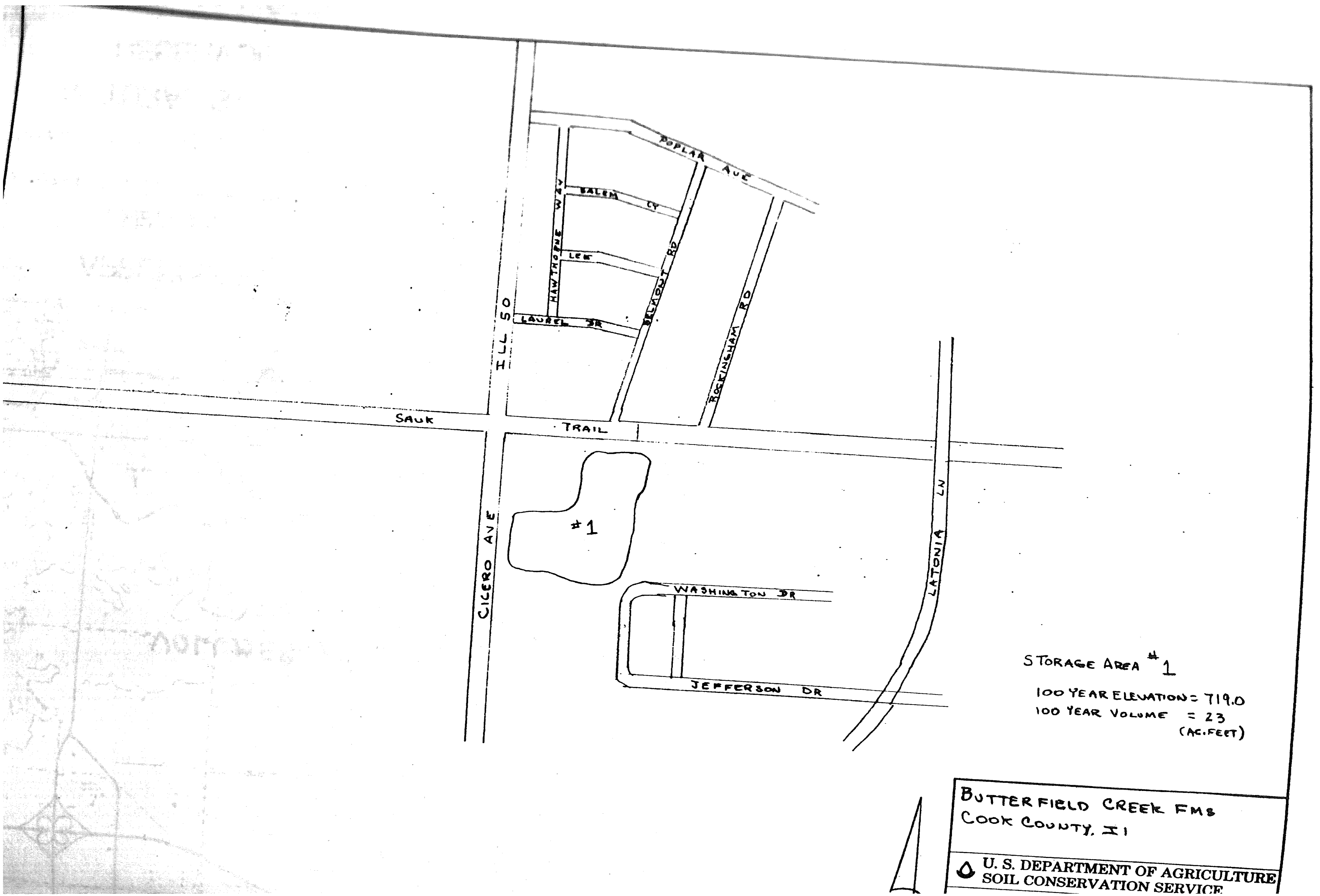
APPENDIX E

LEGEND

Areas not previously mapped

Stream Study

NATURAL STORAGE RESERVOIRS IN TR-20 MODEL

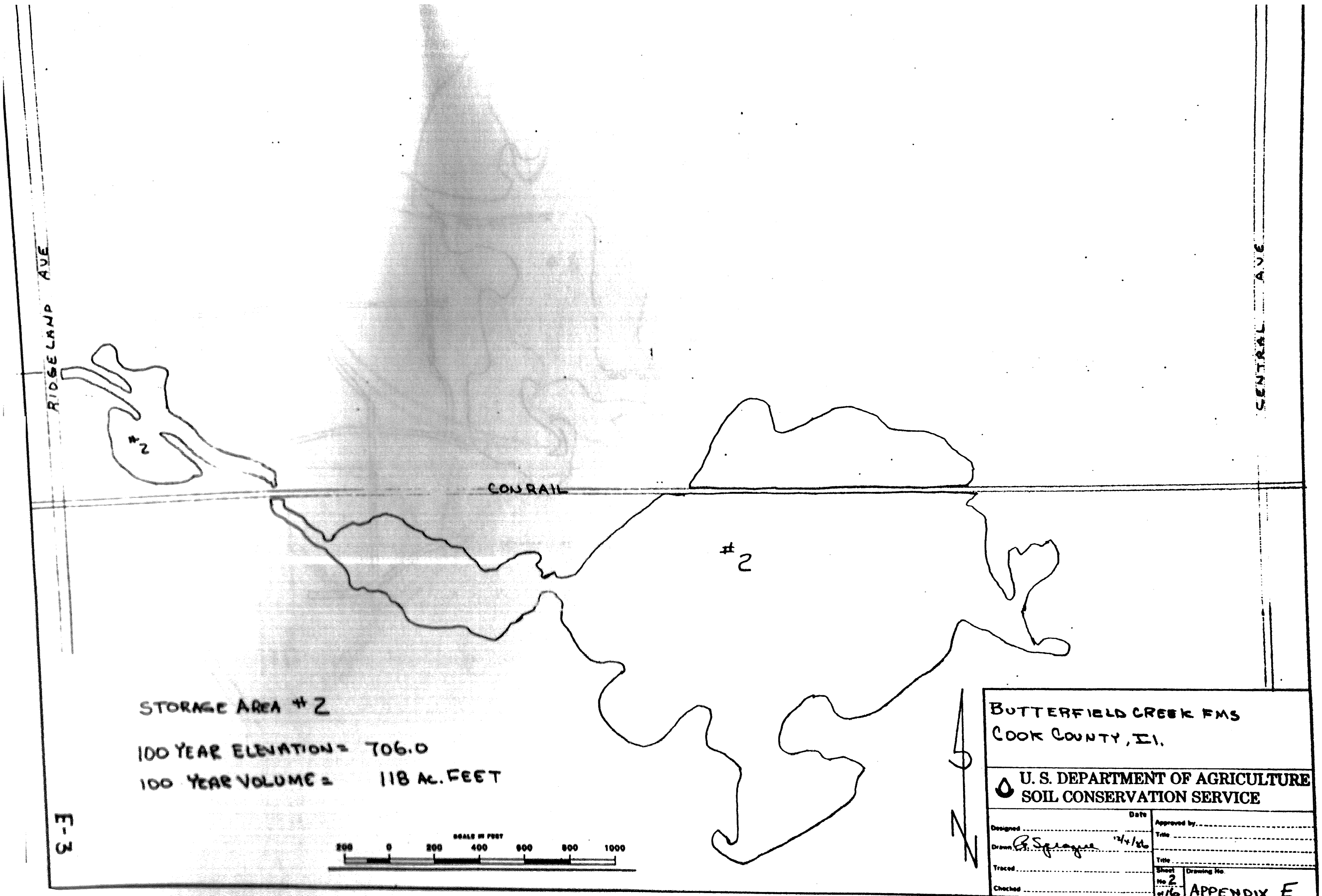


STORAGE AREA #1

100 YEAR ELEVATION = 719.0
100 YEAR VOLUME = 23 (AC. FEET)

BUTTERFIELD CREEK FMS
COOK COUNTY, Il

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE



STORAGE AREA #2

100 YEAR ELEVATION = 706.0

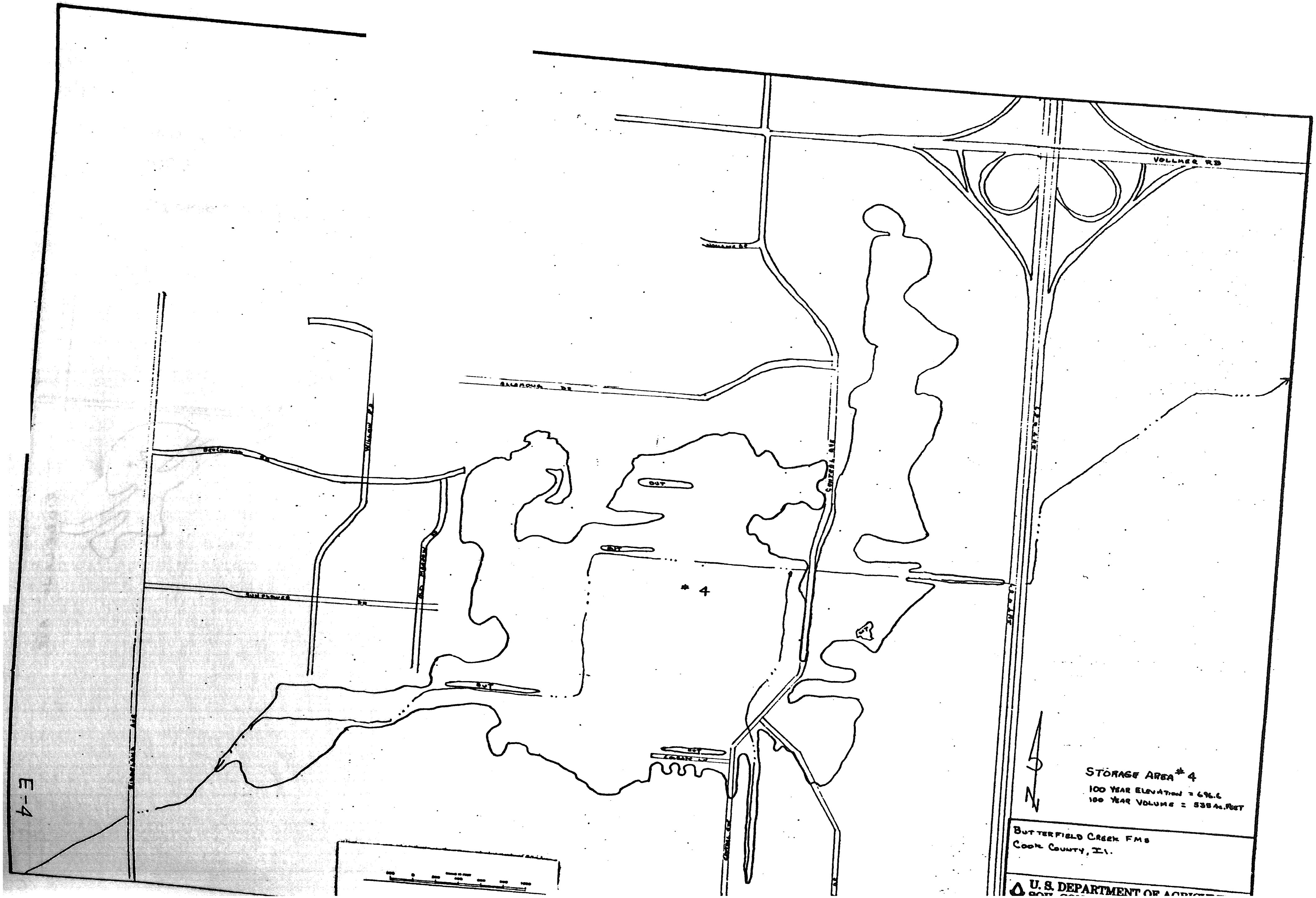
100 YEAR VOLUME = 118 AC. FEET

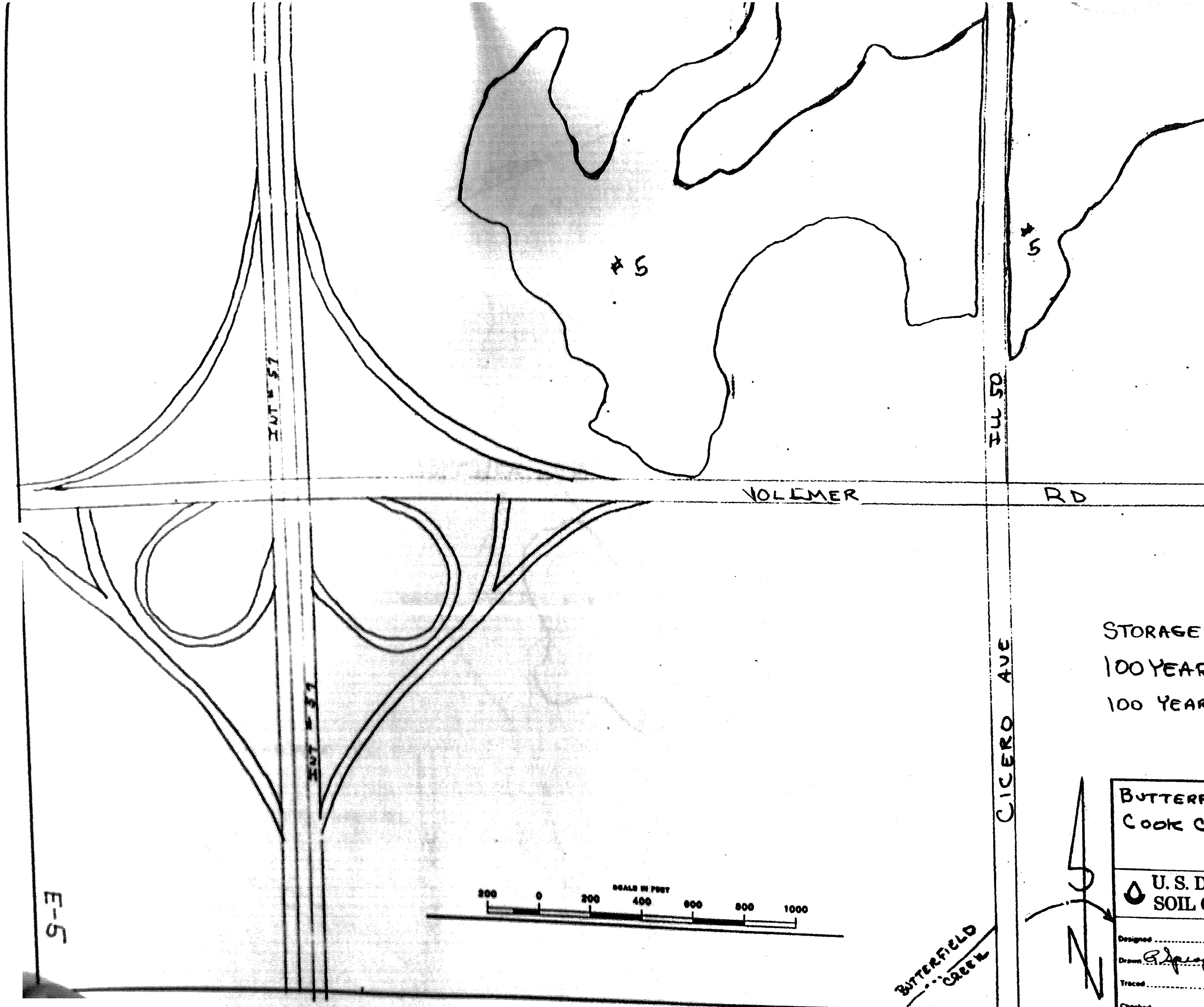
BUTTERFIELD CREEK FMS
COOK COUNTY, IL.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed		Date	Approved by
Drawn G. Sprague		12/4/86	Title
Traced			Title
Checked		Sheet No. 2 of 6	Drawing No. APPENDIX E

SCS-ENG-313A REV 8-75


VOLLMER RD
4
STORAGE AREA # 4
100 YEAR ELEVATION = 696.6
100 YEAR VOLUME = 538 Ac.Feet
BUTTERFIELD CREEK FMS
COOK COUNTY, IL.
U.S. DEPARTMENT OF AGRICU



STORAGE AREA # 5
100 YEAR ELEVATION = 695.3
100 YEAR VOLUME = 190 Ac. Feet

BUTTERFIELD CREEK FMS
COOK COUNTY, Il.

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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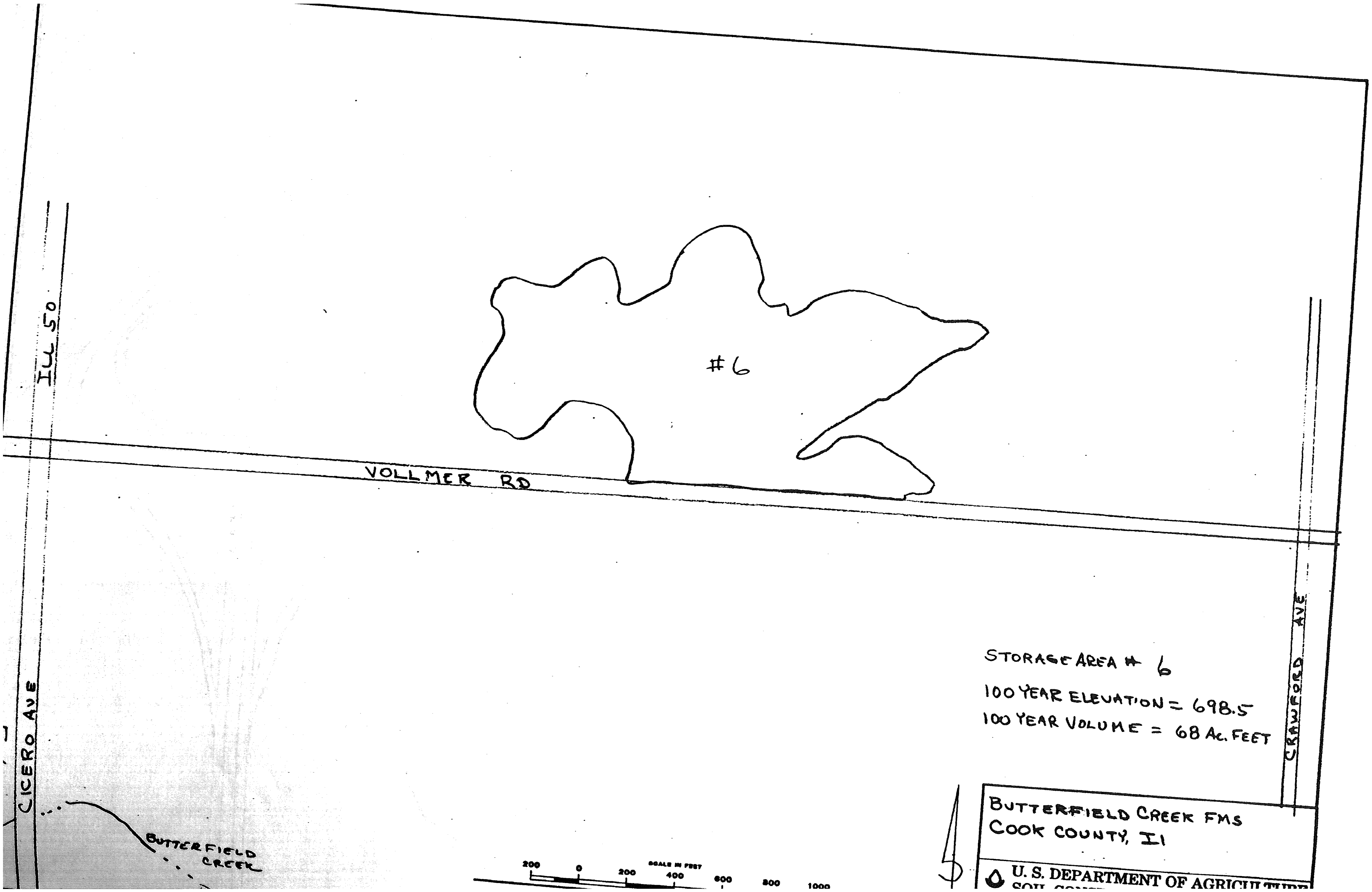
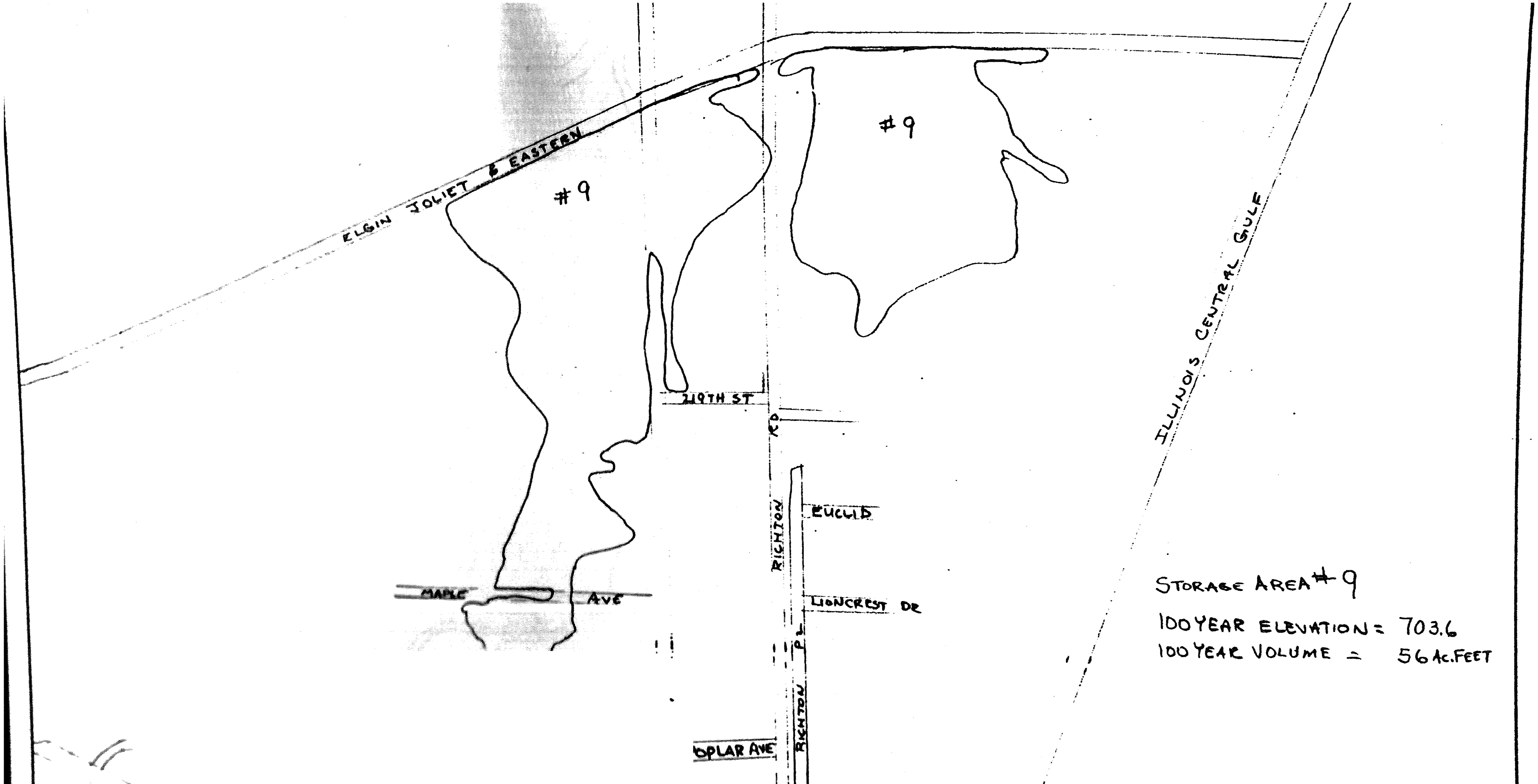
SCS-ENG-313A REV 8-7



IL 50
CICERO AVE
VOLLMER RD
#6
CRAWFORD AVE
STORAGE AREA # 6
100 YEAR ELEVATION = 698.5
100 YEAR VOLUME = 68 Ac. FEET
BUTTERFIELD CREEK
BUTTERFIELD CREEK FMS
COOK COUNTY, Il
U. S. DEPARTMENT OF AGRICULTURE
200 0 200 400 600 800 1000
SCALE IN FEET

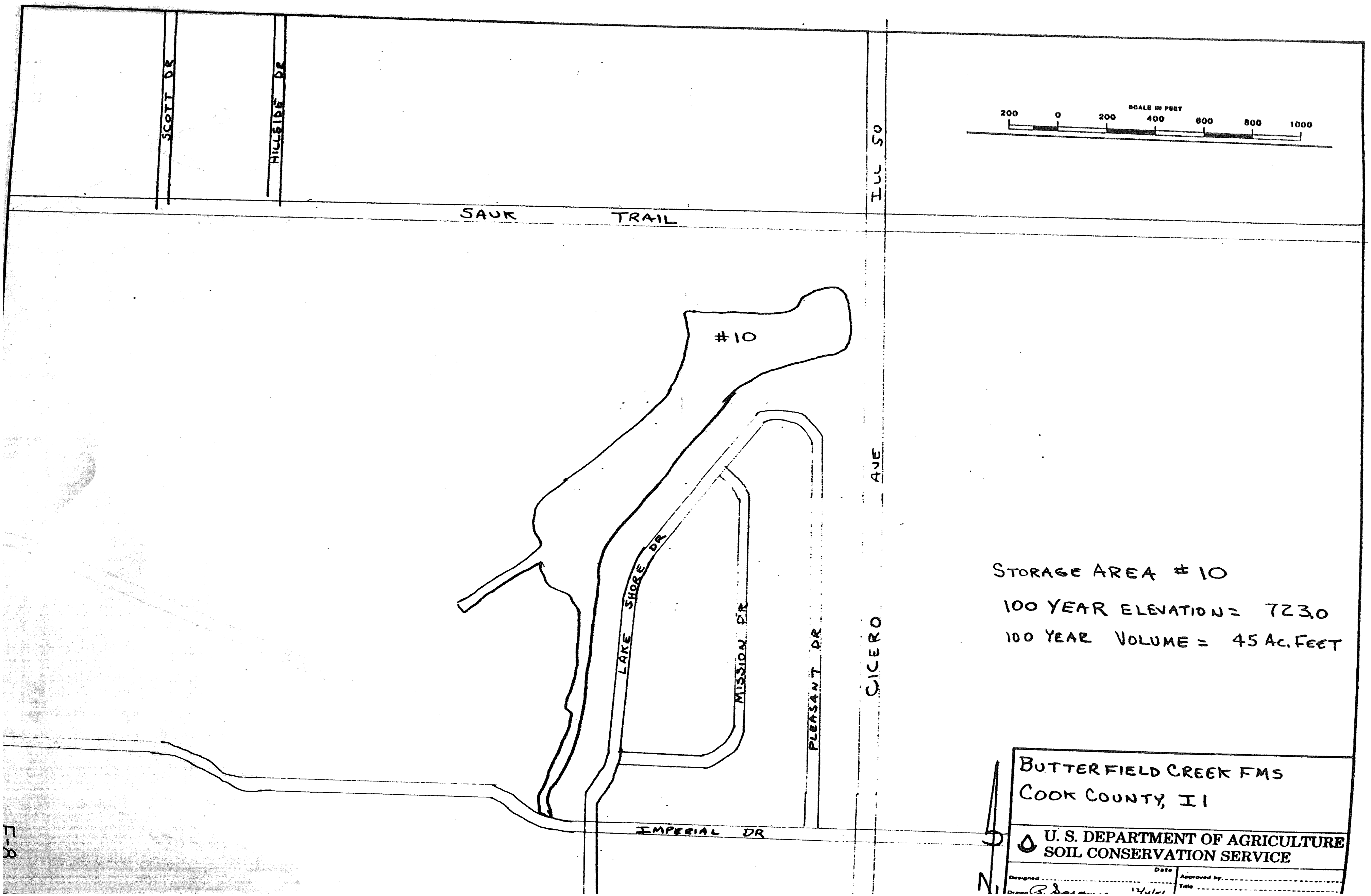


BUTTERFIELD CREEK FMS
COOK COUNTY, Il

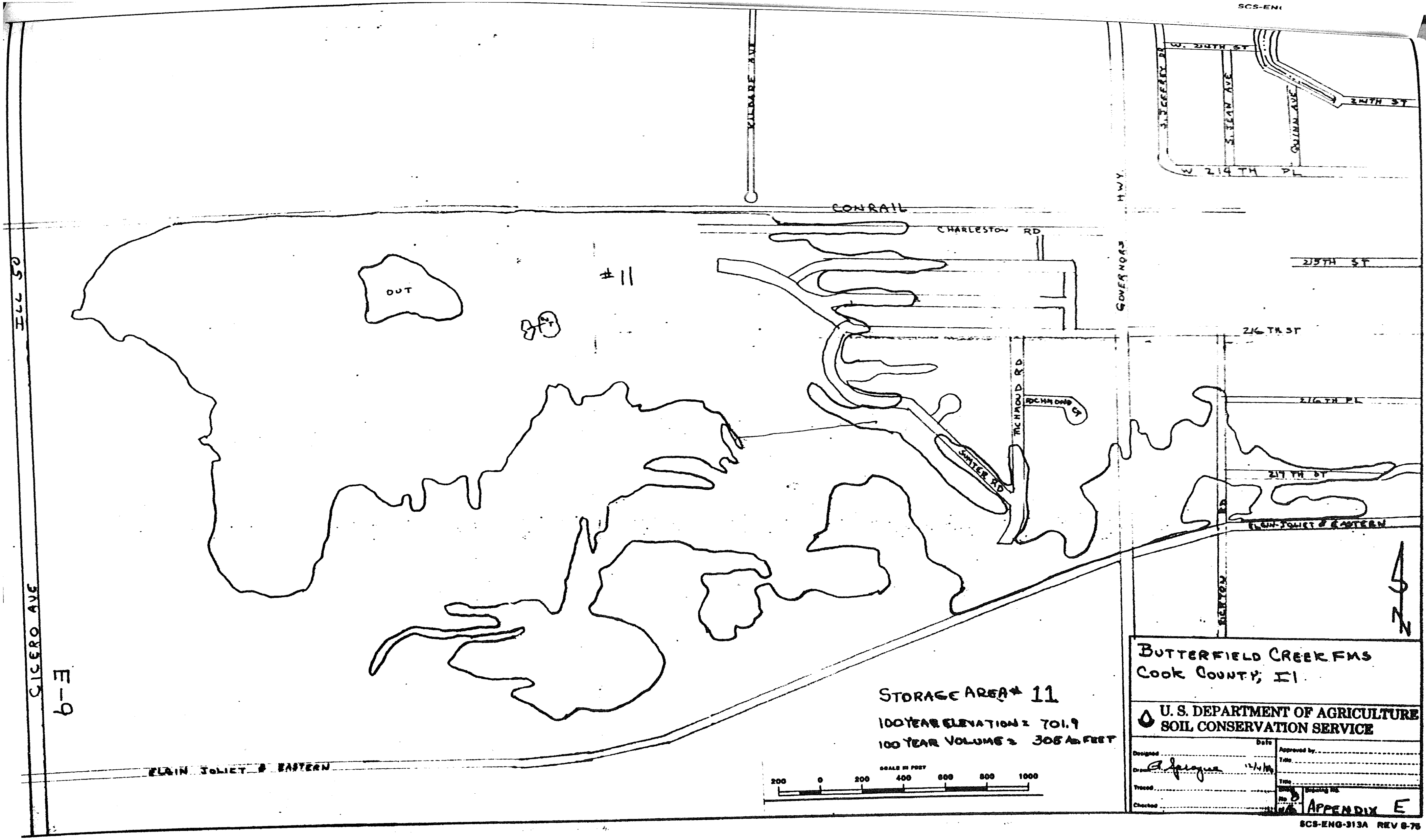
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed		Approved by	
Drawn G. Sprague	Date 12/4/86	Title	
Traced		Title	
Checked		Sheet No. 6 of 16	Drawing No APPENDIX E

SCS-ENG-313A REV 8-75


SCALE IN FEET
200 0 200 400 600 800 1000
SCOTT DR
HILLSIDE DR
SAUK TRAIL
ILL 50
#10
AVE
CICERO
LAKE SHORE DR
MISSION DR
PLEASANT DR
IMPERIAL DR
STORAGE AREA #10
100 YEAR ELEVATION = 723.0
100 YEAR VOLUME = 45 Ac. FEET
BUTTERFIELD CREEK FMS
COOK COUNTY, Il
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed by
Drawn
Date
Approved by
Title
N

F-8



STORAGE AREA # 11

100 YEAR ELEVATION = 701.9

100 YEAR VOLUME = 305 Ac FEET

BUTTERFIELD CREEK FMS
Cook County, Il

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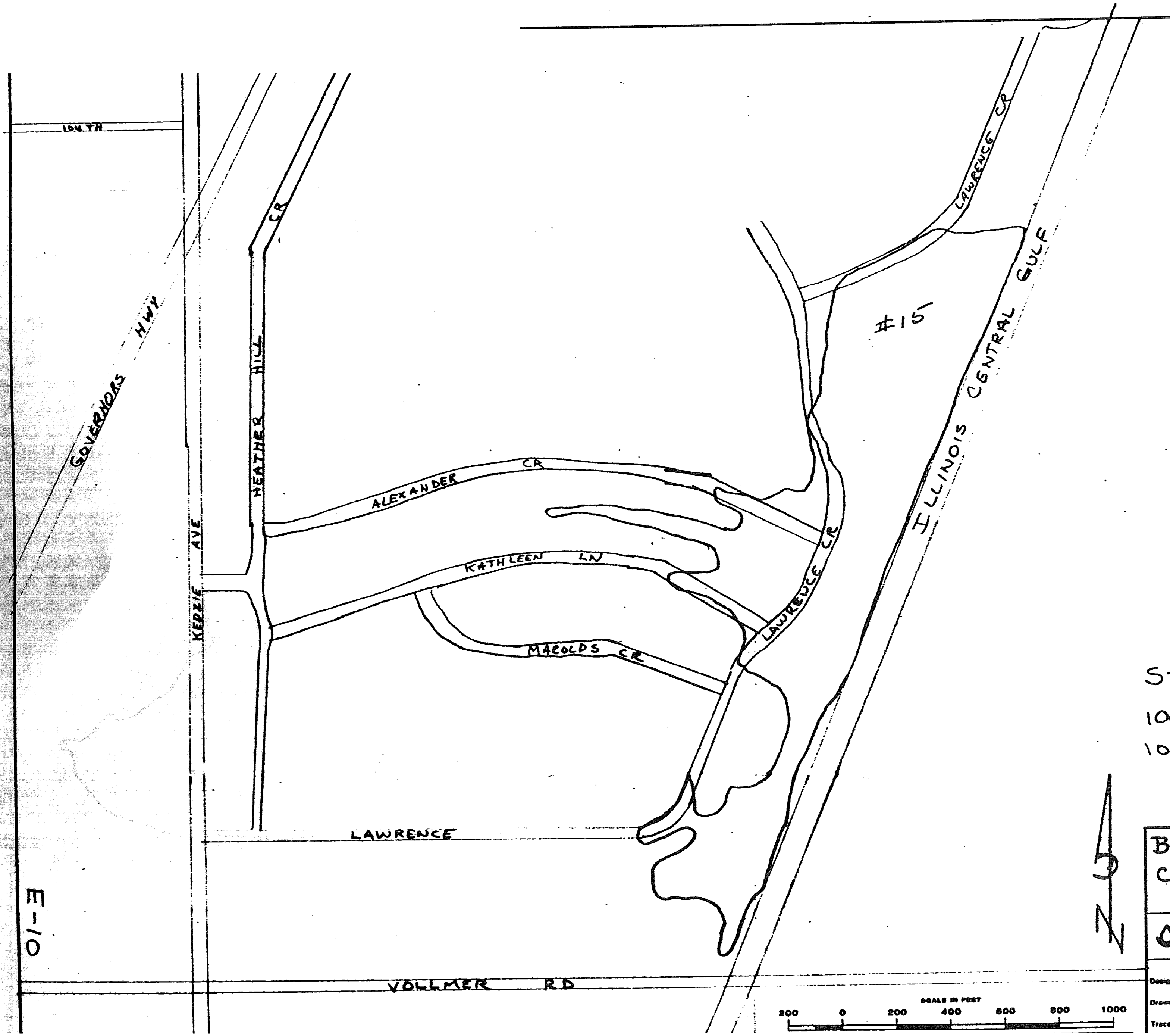
Drawn A. Jacques 12/4/86 Title ......
Traced ...... Title ......
Checked ...... Sheet No. 8 Drawing No. APPENDIX E

SCS-ENG-313A REV 8-75



Storage Area # 15
100 Year Elevation = 671.6
100 Year Volume = 78 Ac. Feet

Butterfield Creek FMS
Cook County, Il

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SOIL CONSERVATION SERVICE

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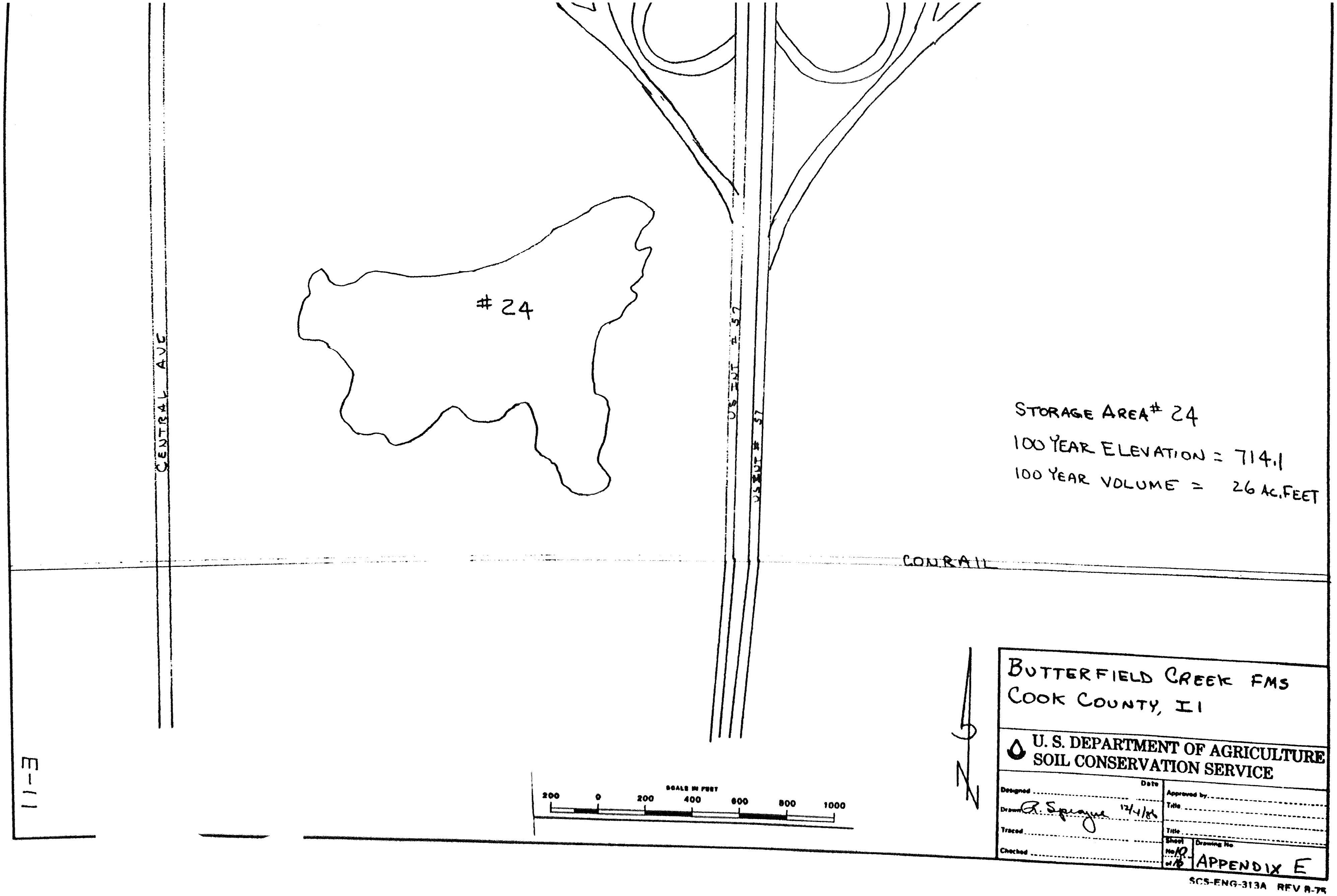
Drawn R. Sprague | 12/4/86 | Title
Traced | | Title
Sheet No. 9 | Drawing No.

E-10


STORAGE AREA # 24
100 YEAR ELEVATION = 714.1
100 YEAR VOLUME = 26 AC. FEET
24
CENTRAL AVE
US INT # 57
US INT # 57
CONRAIL
SCALE IN FEET
200 0 200 400 600 800 1000
BUTTERFIELD CREEK FMS
COOK COUNTY, Il
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed
Date
Drawn R. Sprague 12/4/84
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Approved by
Title
Title
Sheet No. 10 of 15
Drawing No.
APPENDIX E
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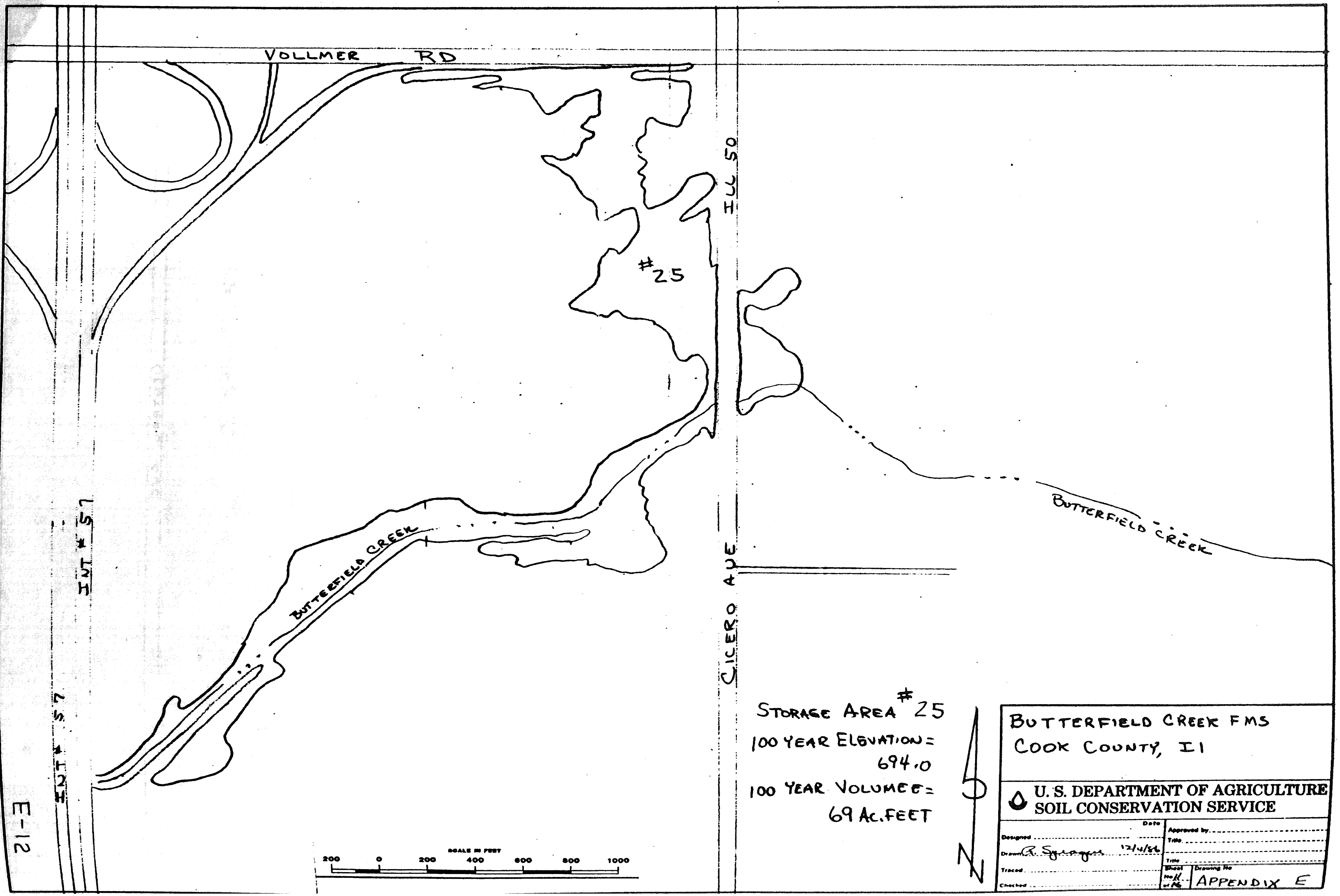

BUTTERFIELD CREEK FMS
COOK COUNTY, Il

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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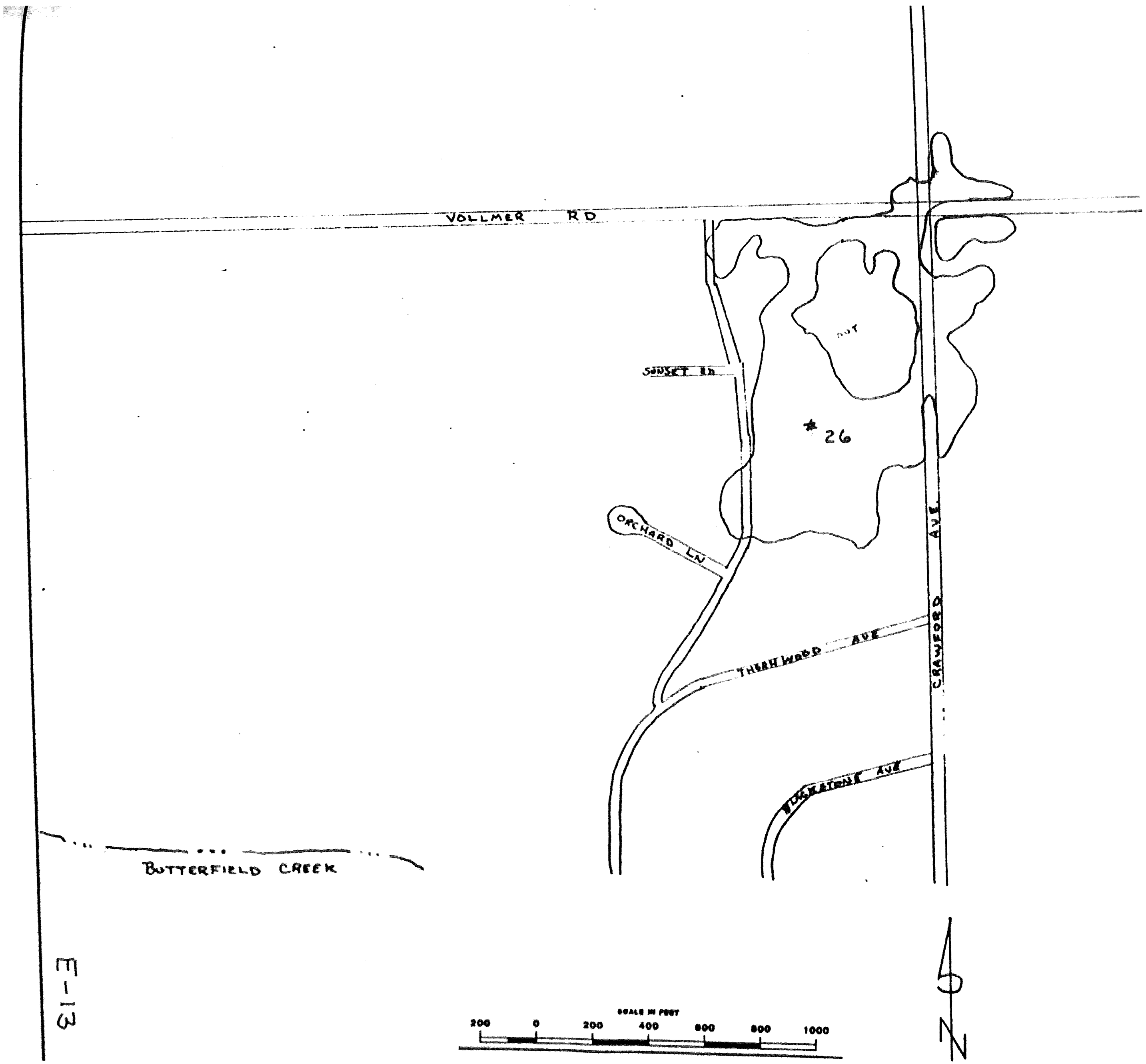

STORAGE AREA # 26

100 YEAR ELEVATION = 696.8

100 YEAR VOLUME = 51 (AC.FEET)

BUTTERFIELD CREEK FMS
COOK COUNTY, Il

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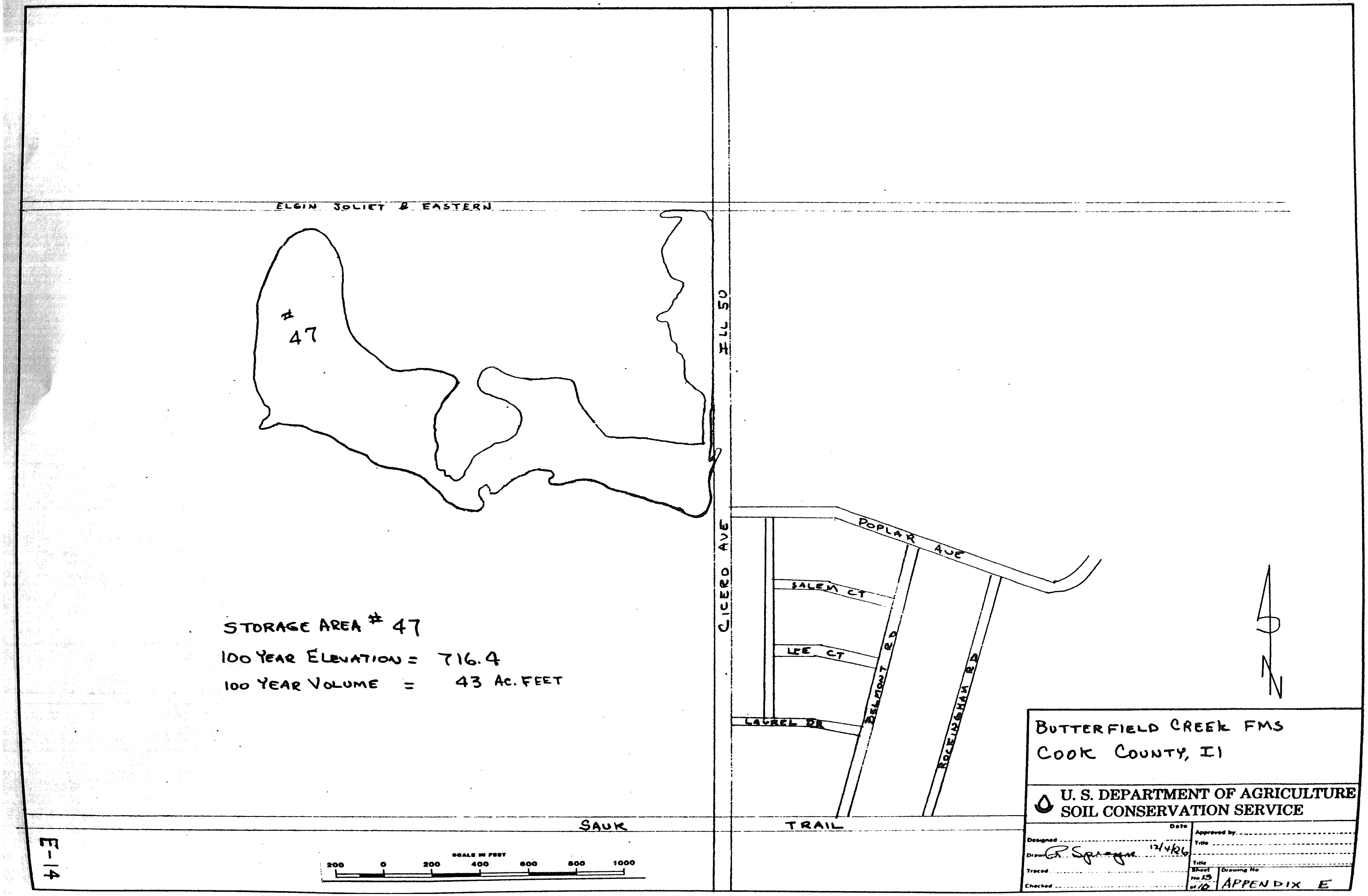
Checked	Sheet No. 12 of 16	Drawing No. APPENDIX E

SCS-ENG-313A REV 8-75



STORAGE AREA # 47
100 YEAR ELEVATION = 716.4
100 YEAR VOLUME = 43 AC. FEET

BUTTERFIELD CREEK FMS
COOK COUNTY, IL

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

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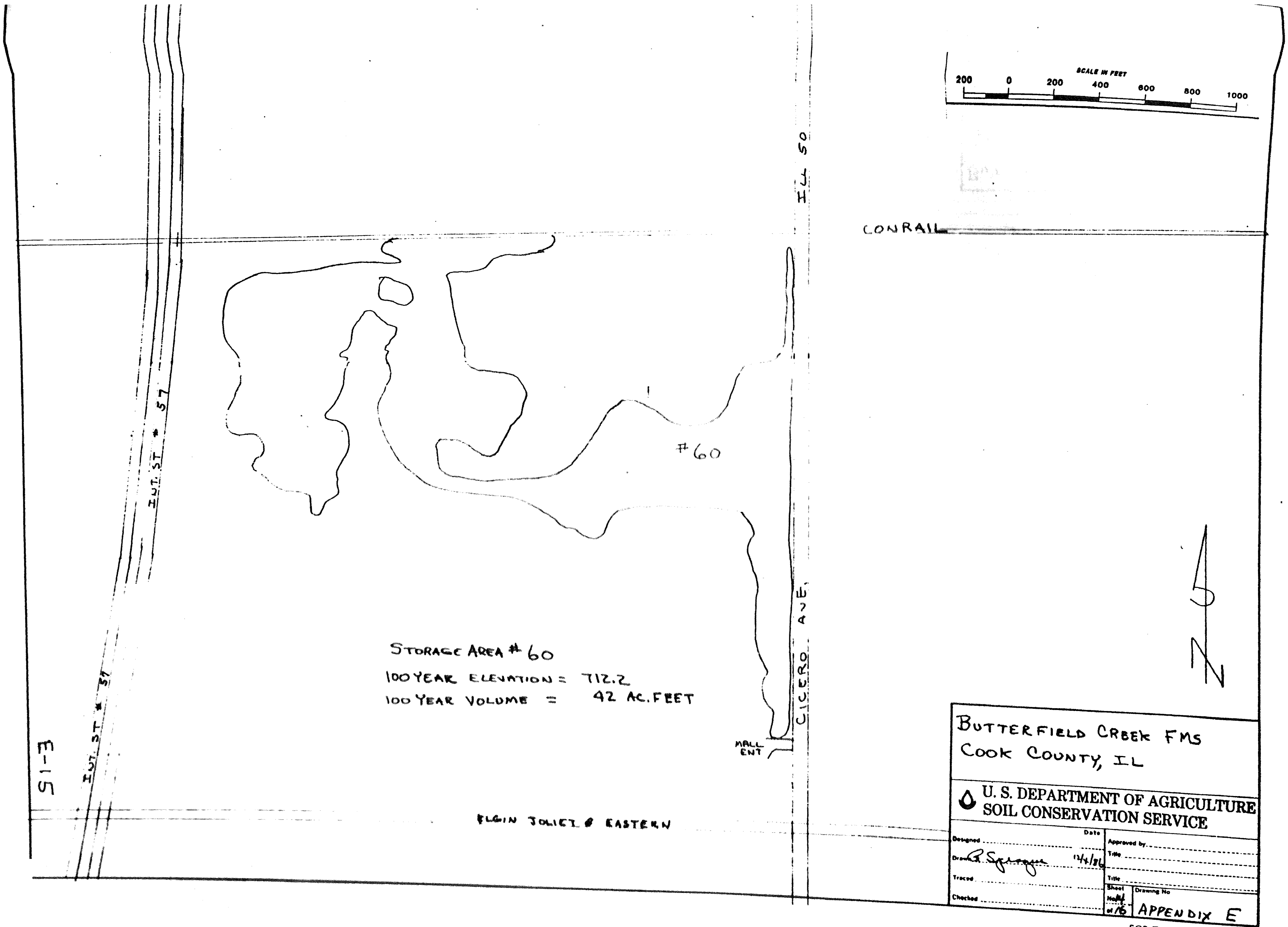
Checked	Sheet No. 13 of 16	Drawing No. APPENDIX E



SCALE IN FEET
200 0 200 400 600 800 1000
CONRAIL
IL 50
IUT. ST # 57
#60
CICERO AVE.
MALL ENT
STORAGE AREA #60
100 YEAR ELEVATION = 712.2
100 YEAR VOLUME = 42 AC. FEET
ELGIN JOLIET & EASTERN
E-15
BUTTERFIELD CREEK FMS
COOK COUNTY, IL
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Designed
Date
Approved by
Title
Drawn R. Sprague 12/4/86
Traced
Checked
Sheet No. of 16
Drawing No
APPENDIX E
SCS-ENG-313A REV 8-75

STORAG

100 YEA ..EVATION

WEST = 707.5

EAST = 705.5

PIT = 696.0

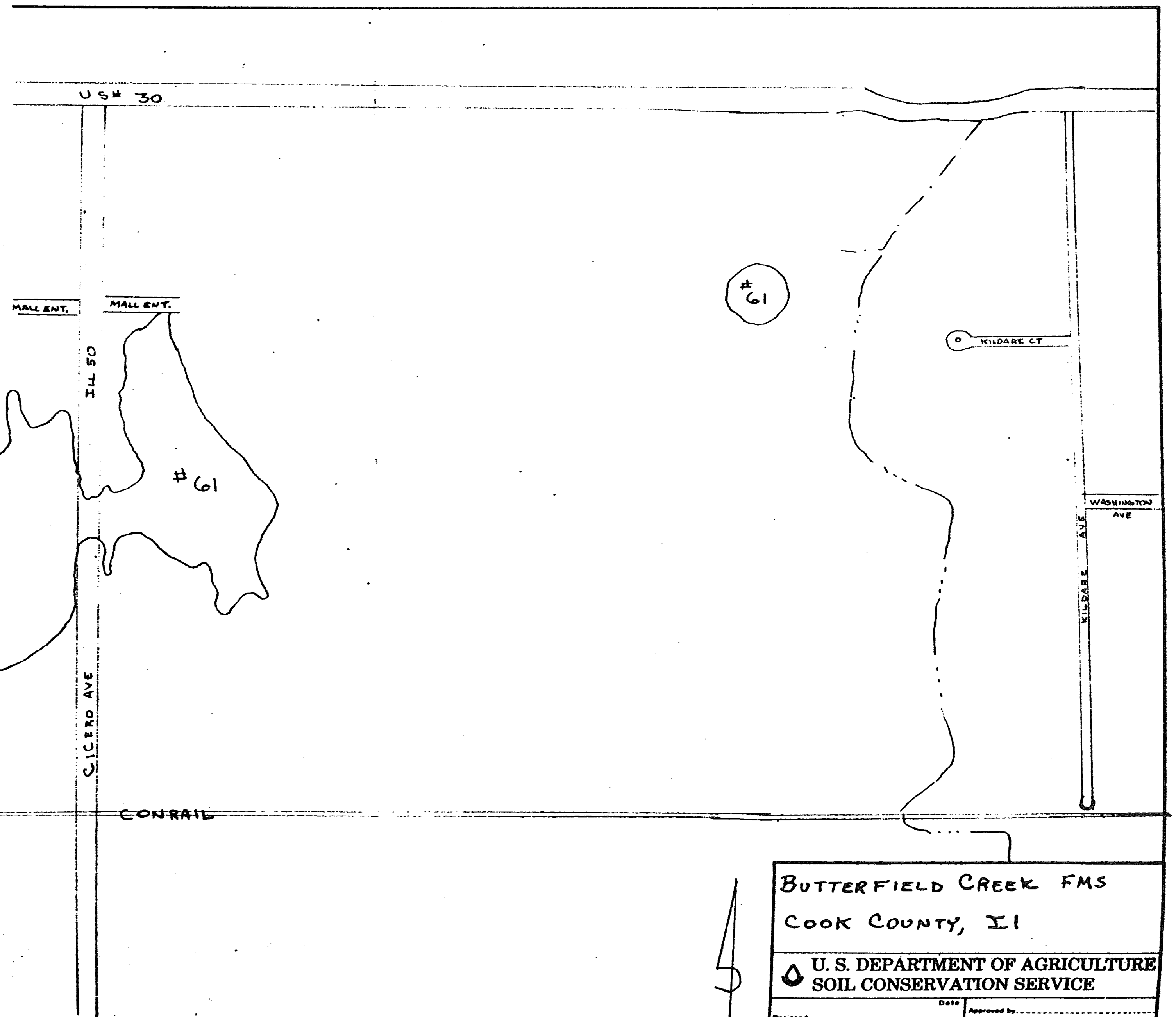
100 YEAR VOLUME (AC. FEET)

WEST = 27.0

EAST = 14.0

PIT = 21.0

62.0



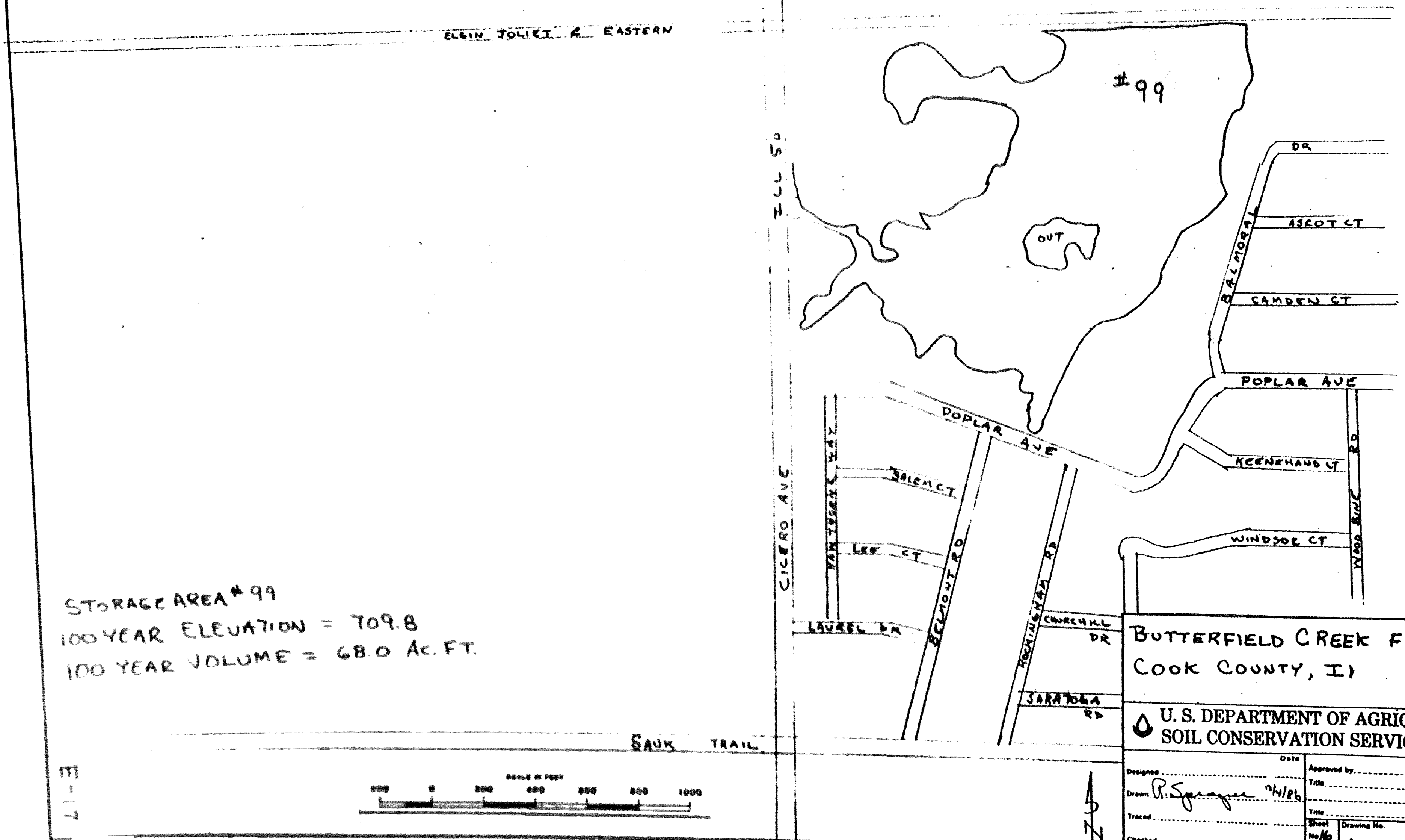
BUTTERFIELD CREEK FMS

COOK COUNTY, IL

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed .... Date .... Approved by .... Title ....

E-



STORAGE AREA # 99
100 YEAR ELEVATION = 709.8
100 YEAR VOLUME = 68.0 Ac. FT.

BUTTERFIELD CREEK FMS
COOK COUNTY, Il

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

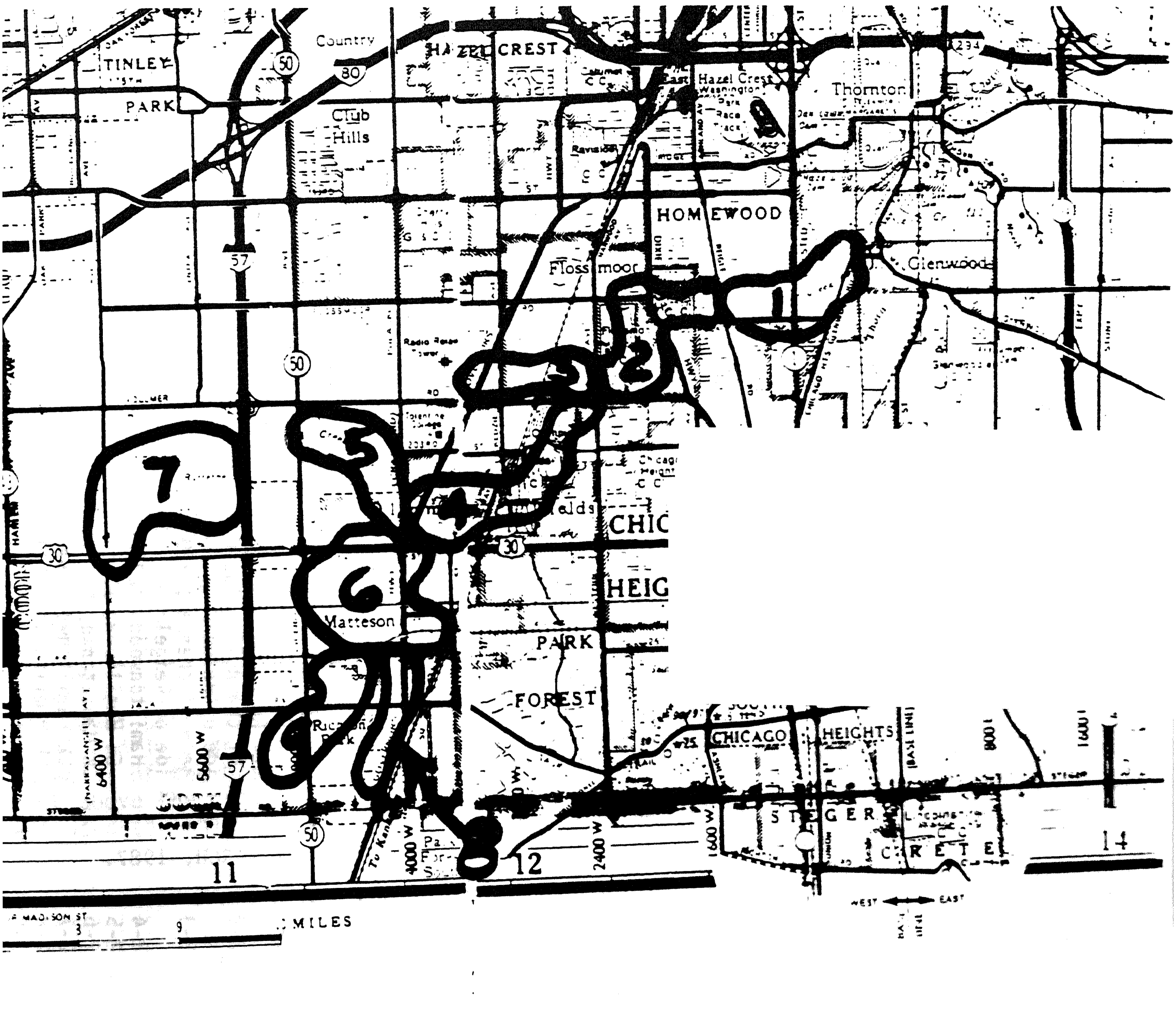
Designed ____ Date
Drawn R. Sprague 7/4/86
Traced ____
Checked ____
Approved by ____
Title ____
Title ____
Sheet No 16 of 16
Drawing No. APPENDIX E

SCS-ENG-313A REV 8-78

APPENDIX F

CLUSTER LOCATION MAP

BUTTERFIELD CREEK WATERSHED
FLOODPLAIN MANAGEMENT STUDY



APPENDIX F
ˎ FLOODPLAIN MANAGEMENT STUDY
ND FLOOD WATER ELEVATIONS

utterfield Creek near Glenwood & Homewood
Cluster 1 & 2

THE COMMUNITIES IN MARCH, 1987.

	ΤΙΟΝ				FLOOD WATER ELEVATION					
					Present Runoff Conditions			Future Runoff Conditions		
					10% chance 10 year	1%chance 100 year	0.2% chance 500 year	10% chance 10 year	1% chance 100 year	0.2% chance 500 year
					611.9	614.7	615.0	611.9	614.7	615.0
1-11	a Pk Hall	"	615.1	615.1	"	"	"	"	"	"
1-12	naint. buldg	"	615.8	615.8	"	"	"	"	"	"
1-13		"	612.9	612.9	"	"	"	"	"	"
1-14		"	614.0	614.0	"	"	"	"	"	"
1-15		"	617.8	610.8	"	"	"	"	"	"
1-16	N of 193rd	5800	627.2	627.2	619.3	620.6	[illegible]	[illegible]	621.0	622.2
1-17	of 193rd	5800	632.3	627.7	"	"	"		"	"
1-18	uldg on 193rd	8100	630.3	630.3	624.8	626.0	627.1	624.9	[illegible]	627.2
1-19	of Apt Buldg	8750	634.8	631.5	626.3	627.5	628.6	626.4	627.6	628.7
2-1	of Creek, W	9900	634.3	634.3	627.8	631.9	632.7	627.8	632.1	632.8
	gel Rd									
2-2	of channel	10050	631.5	631.5	628.5	632.0	632.7	628.5	632.2	633.0
	ide of Reigel									
2-3	se N of channel	10250	632.4	628.6	628.8	632.2	632.9	628.9	632.4	633.2
	ide of Reigel									
2-4	Hamiltonwood	12350	636.2	634.7	632.7	634.4	635.1	632.7	634.5	635.5
2-5	Ck Hamiltonwd	12150	633.4	633.4	632.4	634.1	634.9	632.5	634.4	635.3
2-6	Ck Hamiltonwd	"	634.7	633.3	"	"	"	"	"	"
2-7	Ck Hamiltonwd	12300	635.6	635.6	632.6	634.4	635.3	632.6	634.5	635.4
2-8	Ck Hamiltonwd	12400	633.8	633.8	632.7	634.4	635.1	632.7	634.6	635.5
2-9	golf course	12000	633.0	633.0	632.1	633.9	634.7	632.1	634.2	635.1
	h									
2-10	golf course	12150	634.0	634.0	632.4	634.1	634.9	632.5	634.4	635.3

APPENDIX G
INVESTIGATIONS AND ANALYSIS

Surveys and Mapping

All surveys were performed by the State of Illinois, Department of Transportation, Division of Water Resources (DWR) as part of its contribution as co-sponsors of this study. Detailed surveys included valley cross sections and centerline of roads along with bridge and culvert dimensions for use in analyzing hydraulic characteristics. They also obtained first floor and low water entry elevations for residences, businesses and related structures for use in flood damage analysis.

Detailed topographic maps prepared by IDOT-DWR with 1 inch = 200 feet scale and 2 foot contour interval were used for the initial evaluation of the floodprone areas.

The IDOT maps were used as base maps for alternative evaluation, economic evaluation, expanded basic data, and preparation of floodplain and floodway maps included in this report.

Hydrology

Hydrologic modeling for this study was completed through the use of the SCS Computer Program for Project Formulation (Technical Release 20, Reference 8). This program is an advanced hydrologic model which simulates flood stages and discharges. The stages and discharges are related to watershed characteristics such as drainage area, hydrologic soil group, land use and cover, time of concentration, and channel and floodplain hydraulic characteristics. Given these characteristics and rainfall amounts, the model will develop hydrographs for local drainage areas and perform a specified series of channel and reservoir routings as well as hydrograph additions. The result is peak discharges, hydrograph shape, and runoff volumes at specified locations throughout the watershed.

The present condition model for this study was based on 1985 land use i watershed area and was checked for reasonableness against the histori of 1981. The evaluation is based on the SCS type 2 storm distributi twenty-four hour rainfall values as presented in Technical Paper 40, Department of Commerce - Weather Bureau, May 1961. This analysis in evaluation of the existing storage areas described in Appedix D. Th storage in these areas exceeds 1700 acre feet during the 1% chance s

The future condition model, for the year 2005, was developed by modi runoff curve numbers and times of concentration to reflect increased development. Based on input from local governments and the steering the future condition model also incorporates the installation of on- detention basins on all new development which store 1.5 inches of ru the development and releases the water at a rate of 0.5 cfs per acre developed land draining into the basin. Once the inflow exceeds the capacity of the basin the outflow was estimated to be 2 cfs/acre for foot above the capacity of the basin. Beyond that elevation a large was used to indicate no storage effect on these flows.

The areas that were included as developed in 2005 were based on existing zoning maps of Cook County and the communities involved along with input from the steering committee on the areas likely to develop. Many of the areas are already platted.

The future condition model assumes that all existing natural storage is being maintained in the watershed. Appendix E shows the location of the 16 existing storage areas included in the TR-20 model. The largest of these is reservoir #4 located west of I-57 in Matteson. This reservoir stores over 500 acre feet during the 1% chance storm. According to the communities, they require compensatory storage when the new development is located in floodprone areas beyond the on-site detention requirement.

The flood discharges were submitted for certification in accordance with the state Floodplain Study Review Procedure. The review is conducted by the Illinois State Water Survey with certification by the Illinois Division of Water Resources.

Hydraulics

An analysis of the hydraulic characteristics of the creek was carried out to provide stage estimates for floods of selected recurrence intervals. The water surface elevations (stage) were established utilizing the physical characteristics of the channel including channel size and shape, floodplain size and shape, bridge sizes and shapes, and estimates of Manning's roughness coefficients. The hydraulic computations were made using the SCS Hydraulic Model WSP-2 (Technical Release 61, Reference 9). This model employed the standard step method for backwater profiles which is a computational procedure that estimates total energy at each stream cross section accounting for friction losses between sections. The bridge effects on stream hydraulics were accounted for using the Bureau of Public Roads Method. The bridge method, which is included in WSP-2, was formulated using the principle of conservation of energy. The model employs this principle between the point of maximum backwater upstream from the bridge and a point downstream from the bridge at which normal stage has been established. Culverts were also evaluated using the principle of conservation of energy and depth of headwater and tailwater, the barrel shape and dimensions, type of inlet, and shape of headwall.

The hydraulic model requires the input of peak discharges in addition to the physical characteristics listed above. The peaks were taken from the hydrologic model at appropriate locations. Starting configuration was based on estimated water surface elevations of Thorn Creek. These range from 609.0 for the two year storm to 615.0 for the 500 year storm. Manning's roughness coefficients were estimated on the basis of field observations using the SCS procedures (Reference 11). All elevations are National Geodetic Vertical Datum.

The floodway was determined for all studied reaches. It was computed on the basis of equal conveyance reduction from each side of the floodplain using the SCS Floodway Computer Program (Technical Release 64, Reference 10).

Flood Damage Analysis

The economic data for floodwater damages for this study was gathered by personal interviews with floodplain residents during the fall and spring of 1985 and 1986. Data regarding damages to personal property, business property, loss of income, and the effects of flooding to safety and health was gathered. The final economic evaluation of personal property losses from floodwater was done by use of the Urban Floodwater Damage Economic Evaluation program (URB 1), (Reference 15).

Properties within the floodplain were classified by major type that included basement structures, slab on grade, bi-level, tri-level, apartment, commercial and industrial. Engineering surveys were conducted to determine low water entry point, basement elevation and first floor elevations for each property. Coefficient damage curves published by the Federal Insurance Administration (FIA) and from the other urban studies were used in the URB 1 program to compute damages for each property. Occasionally these were adjusted to correlate with interview data. The coefficient damage curves represent percent damage factors by flood depth for buildings and contents of respective houses or other types of buildings. The URB 1 program locates each property based upon surveyed location and computes damages based upon frequency and depth of flooding related to the damage factors for that respective property.

The program lists the properties damaged for each alternative, and includes the following items for each property.

a) damage to property (building) by each storm
b) damage to contents by each storm
c) sum of property (building) and contents damage by each storm
d) sequence number listing of buildings
e) frequency of each damaging storm in flood series
f) total (building and contents) average annual damage for the property
g) flood elevation for each damaging storm
h) depth of flood in relation to first floor of building
i) frequency damages begin
j) computation of average annual damages for property and contents

Example of URB 1 output.

HOUSE NO. 342 STATION: 111800 (SECTION: ET215 STATION: 111800)
CCF-DAMG: 0

PROPERTY DAMAGE	CONTENTS DAMAGE	PROPERTY & CONTENTS	PCT PROB	FLOOD ELEV	TO 1ST FLOOR	AVG. ANN. DAMAGE PROPERTY	CONTENTS	TOTAL
45000	18000	63000	VAL					
14400	9720	24120	0.2	703.60	2.40	29	19	48
13500	9000	22500	1.0	703.20	2.00	112	75	187
12780	8460	21240	2.0	703.00	1.80	131	87	218
12059	7920	19979	4.0	702.80	1.60	248	164	412
10980	7110	18090	10.0	702.50	1.30	691	451	1142
8500	5100	13600	20.0	702.00	0.80	974	611	1585
0	0	0	25.0	701.90	0.70	213	128	341
				TOTAL AVG. ANN.		2398	1535	3933

The effects of floodwater damages were evaluated for present conditions, future without project, and several structural alternatives.

All damage estimates were based upon current values (1986 price base). Damages from increased values of floodplain property due to expansion of existing facilities or the construction of new units were not evaluated. All of the alternatives were evaluated using a 100 year project life and a discount rate of 8 7/8 percent.

Public Involvement

The local people contacted the Illinois Division of Water Resources requesting that something be initiated to solve the flooding problem made apparent by the flood of 1981. The information provided by the local people indicated that the flooding in the area of Dixie Highway and on the golf courses was increasing as new development occurred upstream of Governor's Highway.

The steering committee that was formed to provide guidance for this study included representatives from the local governments as well as representatives of interested organizations such as the IDOT, Division of Highways, homeowners associations, and the country clubs involved. Also in attendance at several of the steering committee meetings were the Illinois State Representative for this district.

Public meetings were held March 10 and 11, 1987, in Matteson and Flossmoor. Approximately 75 people attended these meetings along with representatives from the local press.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1987—542-701